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THE ILLUSION OF THE KINDERGARTEN PATTERNS.

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Every one that has had occasion to examine attentively a collection of patterns designed for the Kindergarten occupation of mat-weaving, and of course every one practically engaged in

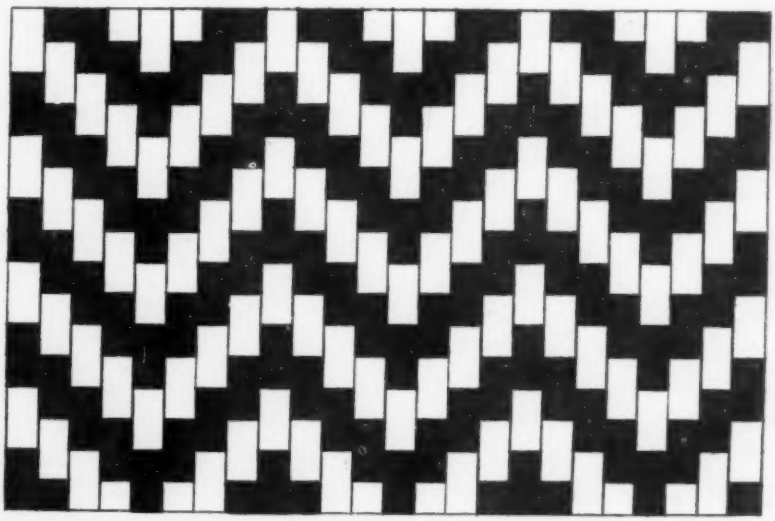

FIG. 1.

this work itself, must frequently have noticed the peculiar irregular appearance presented by the numerous patterns of which the above is a typical representative. Nor does this irregularity escape the notice of the children. A slight examination, how-

ever, suffices to convince one that the irregularity of the vertical lines is only apparent, the seeming departure from rectangular perfection being due wholly to an optical illusion. While casting about for an explanation of this illusion the writer's attention was called to the articles of Heymans[1] and Münsterberg,[2] in which the elementary form of the illusion is figured and discussed. Fig. 2 represents this elementary form as first published by Professor Münsterberg in the Milton Bradley collection of optical illusions.[3] In this collection no name is attached to the illusion, but in the German article it is called 'Die verschobene Schachbrettfigur,' for which 'The Shifted Checker-board-Figure' may be a sufficiently exact, though perhaps less expressive, equivalent in English. The explanations given by the above mentioned authors are widely at variance, Münsterberg appealing to *irradiation* as the chief factor in the matter, while Heymans rejects this and forthwith places this illusion in the same category with those of Zöllner and Loeb, to be explained as a phenomenon of *contrast*. Neither writer gives a sufficiently detailed discussion of the matter to enable the reader to decide definitely between the rival claims. Then, too, while presenting strong arguments in favor of irradiation as the explanatory principle, Münsterberg acknowledges that other factors *may* possibly coöperate to produce the illusion—factors, namely, of contrast, or whatever they may be, which are commonly appealed to in explanation of those illusions of which the Zöllner pattern is a type. In view, then, of the somewhat un-

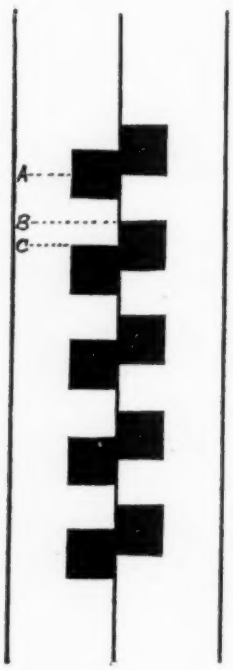

FIG. 2.

[1] Zeitsch. f. Psych., XIV., 118.

[2] Ibid., XV., 184.

[3] Bradley: Pseudoptics, B. 5.—According to the description given by its discoverer in the article above referred to, the complete figure from which this element was taken must have been much like the Kindergarten pattern above figured, squares however taking the place of the rectangles.

settled state of the question, and in view too of the interesting character of the illusion itself, it seemed not amiss to enter upon a qualitative and quantitative examination, the illusion being subjected to as many of its possible variations as seemed likely to throw light upon the problem. It may be stated at once that the general conclusion arrived at as a result of the experiments to be described is that *irradiation* alone seems to be an adequate explanatory principle.

The exact nature of this irradiation must be made clear at the outset. This Professor Münsterberg does admirably in the article referred to, pointing out, at the same time, that it was the failure to rightly apprehend this that led Heymans to his sweeping denunciation and rejection of this explanation. The irradiation-effect here, namely, is not of that simple sort where dark areas surrounded by light are contracted uniformly in such wise that the apparent contours remain everywhere parallel to the actual outlines. For here, in consequence of the form of the figure, there is a point of maximum effect, the result of which is to give the whole line an oblique appearance. In Fig. 2, *e.g.*, consider the portion AB of the middle line. It is not true here that the upper half of this section has been seemingly shifted to the left in a direction parallel to itself, while the lower half remains unchanged. The fact is rather that at the upper end of the line AB the white square on the right has, as it were, *bored into* the black area, giving the angle at that point the appearance of being no longer a right but rather an *acute* angle,[1] so that the upper half of AB seems to slope obliquely downwards from left to right. Similarly BC slopes in the same direction. And the lower half of AB, influenced by the sloping sections above and below, seems to join with them and assume likewise an oblique position. Similarly for each section of the whole middle line. Accordingly, the irradiation that is effective in producing the illusion is that which occurs in the *corners* of the several pairs of squares. This is Professor Münsterberg's explanation of the matter, and its great plausibility is at once evident from an examination of the figure.

[1] How great this boring effect is can be readily appreciated if the attempt be made to fill out the appropriate corners of Fig. 2 sufficiently to destroy the illusion.

With this brief introduction let us enter upon the experimental examination of the illusion.

A. Qualitative.

Strong presumptive evidence in favor of the supposition that one is here in the presence of irradiation-effects is given at once by the fact that the inclination of the middle line (see Fig. 2) appears greatest when the figure is viewed with imperfectly

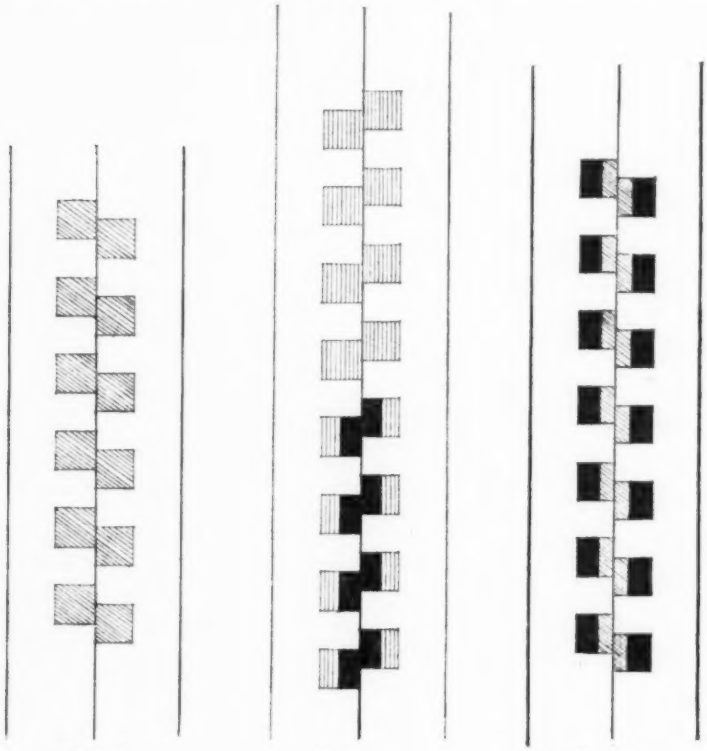

Fig. 3. Fig. 4. Fig. 5.

accommodated eyes—a condition well recognized as most favorable for the appearance of such effects.[1] But above all, the presence of irradiation is shown by the entire disappearance of the illusion when the figure is held in the full glare of a bright light and viewed at a distance of six or eight inches from the eyes. If the paper upon which the figure is drawn be semi-

[1] See Helmholtz, Physiologische Optik, 2d Ed., p. 395.

transparent, the same disappearance of the illusion may be accomplished by holding the figure between the bright light and the eyes.

But may not the alternating and contrasted position of the squares be also influential, wholly aside from the effect of irradiation? Before entering upon a quantitative investigation of the problem, the effort was made to gain an answer to this question. To this end several figures were prepared, the object of each of which was to exclude the possibility of irradiation while retaining the other operative factors, if such exist. In these figures the form of Fig. 2 was adopted, but the squares, instead of

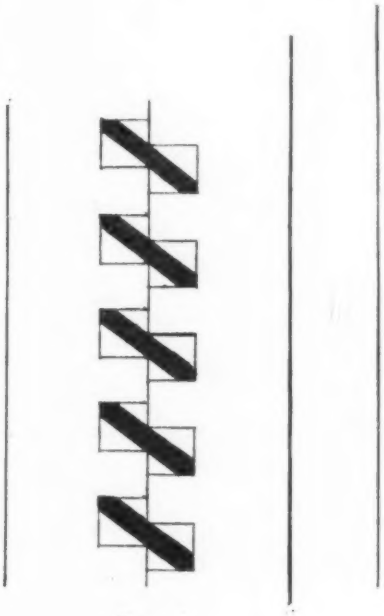

FIG. 6.

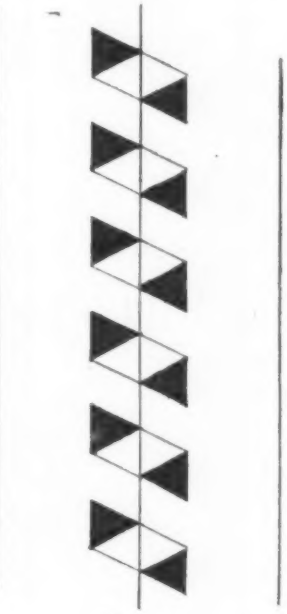

FIG. 7.

being filled with a uniform black, were variously treated with vertical or oblique lines, etc., as shown in the adjoining cuts, 3, 4 and 5. Here the full effect of contrasted squares is present, but no illusion is produced, except in the lower half of Fig. 4, where irradiation becomes possible. Alternately covering either half of Fig. 4 with a piece of blank paper will serve to render clear the difference between the two halves.

Figs. 6 and 7, also, would seem to offer as much 'contrast' as even Heymans would demand, but it is evident that no illusion is produced.

Still more interesting, however, are figures 8 and 9. In Fig. 8 the black squares are brought to within $\frac{1}{48}$ inch of

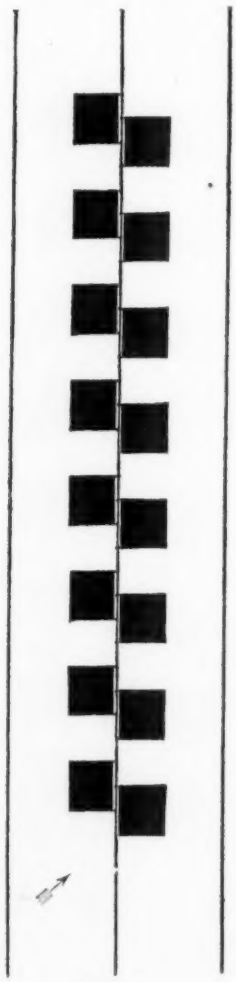

FIG. 8.

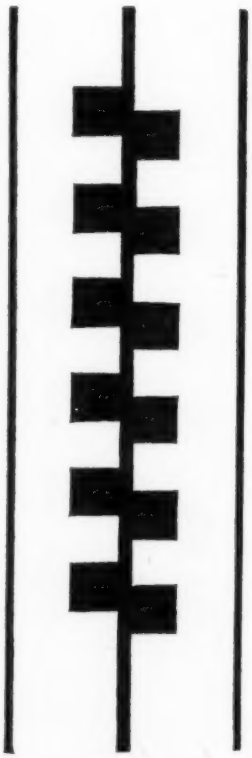

FIG. 9.

the middle line, the characteristics of the typical form being thus retained to the greatest possible extent. If the figure be looked at directly, irradiation is excluded and the middle line

is not deflected. If, however, it be viewed somewhat obliquely as indicated by the arrow, at a distance of 18 inches or more from the eyes, and with the plane of the paper at an angle of 30°–45° to the line of vision, irradiation can become effective to a limited extent and the illusion reappears in proportionate degree.

Fig. 9, on the other hand, offers every opportunity for the working of irradiation, but the heavy middle line precludes that particular direction of its effectiveness which is requisite for the production of the illusion. That is to say, the 'boring' effect in the corners formed by the several pairs of squares is no longer able to produce the tilted appearance of the middle line. For here not only the inner corners formed by each pair of squares, but each and every corner along the middle line offers a boring point for the action of irradiation. Consequently, in so far as the middle line is concerned, these effects neutralize one another, leaving this line unaffected, while instead the white areas at either side seem to have been dovetailed into the black, so tightly do the white squares appear to fit into the inner corners. If one recall in this connection that the original Zöllner pattern was constructed with heavy lines, the non-appearance of linear deflection in the case before us becomes all the more instructive.

That irradiation does produce a maximum effect in the corners of dark areas, so that a right angle is thus made to appear acute, may be readily seen by drawing a square (with an edge, say, of two inches), three-fourths of which shall be black and the remaining fourth white, as in Fig. 10. Here the inner corner of the white square is seemingly the vertex of an angle slightly less than 90°. In fact, by an application of this principle to a variation of the typical figure an illusion of an en-

FIG. 10.

tirely new form may be brought about, as shown in Fig. 11. Here the central line is no longer tilted, for the place of maximum irradiation has been transferred from the outer corners to the centres of the squares. What now occurs is this: The horizontal cross lines, which bound above and below the successive pairs of tiny white squares, receive each a slight deflection in the direction of the full black portion of the larger squares. The upper cross-line is deflected upwards from right to left, and the lower downwards from left to right. At the same time the vertical boundary lines on the right and left receive deflections downwards to the right and upwards to the left, respectively. The result is, as Fig. 11 shows, that each pair of adjacent white squares (which may be apperceived as a single white bar crossing the central line), seems to slope slightly downwards from left to right. By diminished illumination this becomes still more apparent. In fact all these illusions due to irradiation come out very clearly when viewed under reduced illumination, as, *e. g.*, when drawn upon semi-transparent paper and viewed from the back, the blank side, that is, being towards the face.

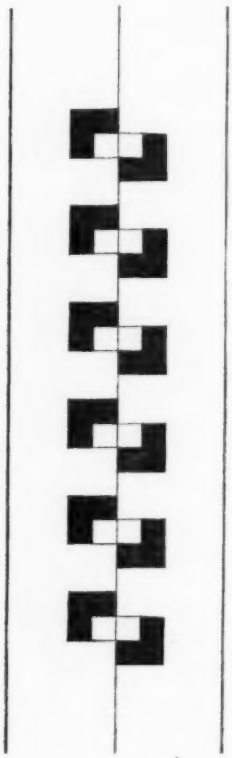

FIG. 11.

Of still greater interest in certain respects is Fig. 12, which grew out of the attempt to exclude irradiation by presenting one line of squares only to each eye, the two being united into a single figure by ordinary stereoscopic methods. Of course, the union into the desired figure is impossible unless certain well marked portions of the original figure be retained and presented to each eye. Otherwise the two vertical lines of squares would simply coalesce. Fig. 12 represents the adopted form which fulfills the required conditions very satisfactorily. Hold a paper-cutter, or similar object, between the figure and the eyes in such

a way that each eye receives only its appropriate image. Converge the eyes for some distant object and the single compounded figure will appear. At first this will present the appearance of Fig. 8, a stripe of white running down between the squares, but if the illumination be reduced by shading the diagram from the source of light, or by allowing the illumination to pass through several thicknesses of transparent paper, after a little the wished-for figure will appear wholly in black and exactly like the typical form, but *with no trace of the illusion*. To be sure, on account of retinal rivalry, the white stripes will frequently reappear, but if the illumination be properly adjusted and the white parts be darkened by rubbing lightly with a hard lead pencil the compounded figure can be made to retain its desired state long enough for a thorough and satisfactory examination.

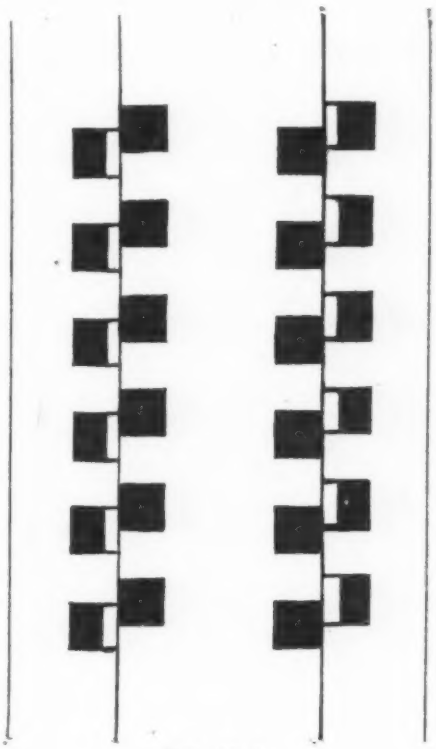

FIG. 12.

Of course, I am far from claiming that in this experiment irradiation alone has been excluded while all three factors, such, *e. g.*, as that of 'contrast,' have been retained in full force. Although, perhaps, we have most closely approximated the desired form of the experiment that shall possess these latter qualifications, we can by no means draw any absolute conclusion. For, while in the compounded figure every possible condition of *geometrical* form and contrast is present, it would be evidently unwarrantable to conclude from the absence of the illusion that therefore the factor of 'contrast,' or what not, is without influence

in this particular illusion. For, if what is meant by 'contrast' here be a physiological matter, as it presumably is to a greater or less extent, its effectiveness in this case must be diminished, in some measure at least, since neither eye receives the full contrast-effect as from the typical figure seen by both eyes alike. And yet one must acknowledge that, owing to the manner of constructing the parts of Fig. 12, the greater portion at least of all contrast possibilities has been preserved in each of the two parts. Still, all that the experiment can be made to prove with absolute decisiveness is that, when irradiation in corners is rendered impossible, the illusion under discussion fails to appear. And, as a means of demonstrating this, the above seems to be a convenient and effective method.

There has now been established, it seems to me, a rather strong presumption in favor of irradiation as the only necessary explanatory principle for the Münsterberg illusion. That this presumption becomes overwhelmingly strong will be seen when the supplementary evidence derived from the quantitative investigation has been considered. For, as the subsequent text will endeavor to show, all conditions that in any way alter the character and amount of irradiation alter in the same degree the amount of apparent angular displacement undergone by the middle line. Let us turn therefore to the quantitative portion of our task.

B. Quantitative.

The purpose of the quantitative investigation was to ascertain as far as possible the influence of various factors in determining the amount of the illusion. Such factors are, *e. g.*, the *vertical distance* between the squares on either side; the length of the *free edge* along the middle line; the *color* of the background and of the squares; the character of the *illumination* as changed by interposing colored media between the eyes and the figure, or as conditioned by causing the figure to be viewed through a pinhole, or under the momentary flash of the electric spark; etc., etc.

The apparatus employed throughout was of the most simple character. Numerous cards were prepared, all being furnished

with half-inch squares at varying vertical distances, arranged along the inner edge of each card, much as in the case of the Bradley model, so that the desired amount of overlapping edge could be readily adjusted. These cards were brought together in appropriate fashion along the middle line *on* of the board *FH* (Fig. 13). Parallel to the actual middle line were stretched threads *am* and *bs*, fastened below to the board itself but above to a sliding rod *KL*. This rod, being attached to a car travelling upon a firm support, could be moved to any amount and in either direction by means of a thumb-screw not indicated in the figure. By this means the vertical threads could be brought to a position of parallelism with the apparently deflected middle line *on*, assuming, *e. g.*, the positions indicated in the figure by the dotted lines *cm* and *ds*. A scale was attached to one end of the rod *KL*, and the amount *ac* (= *bd*) of horizontal movement could be read micrometrically to the hundredth of a millimeter. Then the angular displacement α, which stands for the amount of the illusion, could be calculated from the simple formula $\tan \alpha = \frac{ac}{am}$.

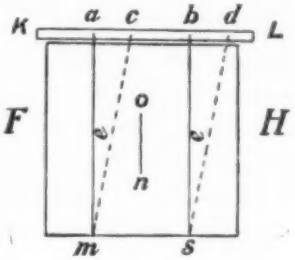

FIG. 13.

The entire apparatus was hidden behind a screen of black cardboard, a window in which disclosed the central part of the prepared cards and the parallel threads. This window was 17 cm. in width and varied in height from 16–20 cm., as the particular experiment demanded. In general, six pairs of squares were used, exceptions to this being in the experiments described in Tables I. and VI., where eight and five pairs respectively were used. The parallel threads were two inches apart and equidistant from the middle line. The illumination, except in the single case where the electric spark was used, was diffused daylight. The eyes of the observer were at a distance of 70–80 cm. from the cards, this range of movement being deemed advisable in order to allow free access to the thumb-screw and in order to prevent fatigue arising from the attempt to maintain a

fixed position. The plane of the cards formed an angle of 90° with the line of vision. The observer himself set the threads in the desired position, and as much time and as much shifting were allowed as were necessary to bring the threads into satisfactory parallelism with the middle line. In any series of experiments parallelism was established alternately from the left and from the right. The usual regulations as to practice, fatigue, etc., were carefully regarded.

In proceeding with the experiments it soon became evident that only a trained observer could give reliable and utilizable results. For the illusion is of such a character that a certain method of procedure must be acquired by each observer before a satisfactory parallelism between the three lines can be established. As Münsterberg has pointed out,[1] the middle line does not always appear to be deflected *as a whole*. The fact is rather that each portion of the middle line that unites the pairs of squares seems to be deflected by itself, and these partial deflections must be apperceived together before the illusion can extend to the whole line. From this consideration it will be seen how difficult it is in many cases to decide upon a position of parallelism, and how necessary a sufficient training and the adoption of a particular method are in the production of reliable and comparable results. In general, the method employed was to allow the eyes to move freely, the gaze being directed principally to the *middle* portions of the figure and *both* threads being considered in the judgment of parallelism. In the attempt to carry out this method there arose, of course, slight individual differences of observation. These, however, were unessential, the only point to be insisted upon being that such individual peculiarities should remain constant throughout the experiments. In view of the difficulties just noted, the tables given below contain the records of only three observers, C., E. and P., each of whom possessed the requisite amount of preliminary experience.

In the following tables the letters of the first column designate the observers. Series 1, Series 2, etc., at the heads of columns signify that the amount of the *free* inner edge of the overlapping squares was respectively one-fourth, two-fourths, three-fourths

[1] Loc. cit., p. 187.

and four-fourths of the length of the edge itself. This edge was in every case a half inch in length. The numbers in these columns indicate the apparent angular displacement, or in other words the amount of the illusion under the given conditions. Column N shows the number of observations, and the adjacent column gives the mean variation of the single judgments to the nearest minute of arc.

TABLE I.—V. D. (VERTICAL DISTANCE BETWEEN SQUARES) = ¼ IN.

Observer.	Series 1.	N	M.V.
C.	8°23′.1	3	62′
E.	10°48′.6	5	30′
P.	10°49′.3	5	78′
Av. and Tot.	10°0′.3	13	

TABLE II.—V. D. = ⅜ IN.

Observer.	Series 1.	N.	M.V.	Series 2.	N.	M.V.	Series 3.	N.	M.V.
C.	11°21′.2	3	66′	9°42′.3	3	71′	0°40′.5	4	6′
E.	11°19′.2	3	40′	9°31′	3	28′	2°40′.4	3	40′
P.	13° 4′.4	4	6′	11° 5′.6	4	42′	1°14′.1	3	26′
Av. and Tot.	11°54′.9	10		10° 6′.3	10		1°31′.6	10	

TABLE III.—(NORMAL.) V. D. = ½ IN.

Observer.	Series 1.	N.	M.V.	Series 2.	N.	M.V.	Series 3.	N.	M.V.
C.	12°13′.3	4	49′	**12°51′**	6	16′	8°47′	5	71′
E.	11° 0′.5	4	44′	**11°56′.4**	4	71′	9°23′	5	38′
P.	16°10′.3	4	66′	**17°19′**	4	43′	8°16′.8	7	42′
Av. and Tot.	13° 8′	12		**14° 2′.1**	14		8°48′ 9	17	

TABLE IV.—V. D.=⅝ IN.

Observer.	Series 1.	N.	M.V.	Series 2.	N.	M.V.	Series 3.	N.	M.V.	Series 4.	N.	M.V.
C.	8°40′	4	46′	10°31′.5	4	52′	8°48′.7	4	55′	5°52′.5	4	34′
E.	9°26′.5	3	28′	11°25′.8	3	49′	10°36′	3	45′	6°52′.4	3	11′
P.	10°14′.5	3	59′	11°21′.7	4	54′	10°45′.8	4	84′	6°49′.5	4	55′
Av. and Tot.	9°27′	10		11°6′.3	11		10°3′.5	11		6°31′.5	11	

TABLE V.—V. D.=¾ IN.

Observer.	Series 1.	N.	M.V.	Series 2.	N.	M.V.	Series 3.	N.	M.V.	Series 4.	N.	M.V.
C.	6°47′.4	2	39′	7°23′.9	2	23′	6°21′.3	2	13′	5°22′.3	3	33′
E.	7°41′.6	3	13′	8°7′.2	3	44	7°43′.	3	35′	3°39′.6	3	30′
P.	7°20′.4	4	49′	7°48′.2	4	45′	6°2′.1	4	32′	3°59′.6	4	25′
Av. and Tot.	7°16′.5	9		7°46′.4	9		6°42′.1	9		4°20′.5	10	

TABLE VI.—V. D.=1 IN.

Observer.	Series 1.	N.	M.V.	Series 2.	N.	M.V.	Series 3.	N.	M.V.	Series 4.	N.	M.V.
C.	5°23′.7	3	66′	7°24′.3	3	31′	5°31′.8	3	16′	3°56′.	3	47′
E.	4°55′.7	3	19′	5°29′.3	3	35′	5°22′.3	3	48′	3°26′.5	3	48′
P.	6°14′.7	3	45′	7° 3′.4	3	69′	5°13′.2	3	16′	5°11′.8	3	49′
Av. and Tot.	5°31′.4	9		6°39′	9		5°22′.4	9		4°11′.4	9	

The following observation may be made on these tables. Taking a downward glance through the tables and comparing the corresponding series reveals the fact that increase of vertical distance between the squares is attended, first, by increase and then by decrease in the amount of the illusion. The maximum in each case is reached in Table III., where V. D. and edge of squares are equal. Table III. may be said to represent the *normal* form. Tables IV., V. and VI. show by series 4 that the

illusion still persists where there is no overlapping but merely a touching of the corners.

A horizontal glance discloses the fact that, with the exception of Table II., the maximum illusion is reached in series 2, where free edge and overlapping edge are equal. In Table II., series 1 shows the largest results, but, as great subjective difficulty was felt here, as also in the experiments of Table I., because of the zigzag character of the line, no importance is attached to this fact. The *maximum illusion* is then in series 2 of Table III. That is, what we have previously called the *typical* form (Fig. 2) presents the illusion under its most favorable conditions.

TABLE VII.—NORMAL FORM. MIDDLE LINE HEAVIER.

Observer.	Series 2.	N.	M.V.	Normal.[1]	N.	M.V.
C.	8°44′.3	4	36′	10°12′.8	4	49′
E.	9°38′.8	3	43′	11°41′	3	43′
P.	11°48′.7	4	17′	17°10′.2	4	2′
Av. and Tot.	10° 3′.9	11		13° 1′.3	11	

The facts noted in connection with Fig. 9 suggested measuring the illusion in its normal form but with the middle line emphasized by introducing between the edges of the cards a piece of No. 50 black cotton thread. The left-hand columns give the results. A 'normal' was measured at the same time, the results being given in the right-hand columns. It will be seen that a heavier middle line considerably reduces the illusion.

TABLE VIII.—NORMAL: VIEWED THROUGH PINHOLE.

Observer.	Series 2.	N.	M. V.	Normal.	N.	M.V.
C.	4°33′.8	4	78′	9°32′.5	4	29′
E.	9°40′.9	4	68′	11°56′.4	4	71′
P.	14° 3′.7	4	85′	15°52′.5	4	39′
Av. and Tot.	9°26′.1	12		12°27′.1	12	

Fick[2] has prettily shown that the amount of irradiation varies with the width of the pupil of the eye. A 'normal' form was accordingly viewed through a pinhole whose diameter was ap-

[1] In this and the following tables, 'Normal' refers to the form of Table III., Series 2.

[2] Fick, Archiv für Ophthalmologie, II., 2 (1856): 70–76.

proximately 1 mm., and records without the use of the pinhole were taken at the same time for comparison. The results are shown in the respective columns of Table VIII. The illusion is seen to be diminished. So far as I can judge, the illusion of the Zöllner patterns is not thus diminished when viewed in this way.

TABLE IX.—NORMAL: ELECTRIC SPARK.

Observer.	Series 2.	N.	M.V.	Normal.	N.	M.V.
C.	9°33′.4	2	92′	10°36′.6	2	48′
E.	7°11′.8	2	169′	12°20′	2	49′
P.	8°57′.3	2	66′	16° 8′.6	40[1]	
Av. and Tot.	8°34′.2	6		13° 1′.7		

Here, again, the diminution of the illusion under changed conditions of illumination is very apparent.

TABLE X.—WHITE SQUARES ON BLACK. V. D. = ½ IN.

Observer.	Series 1.	N.	M.V.	Series 2.	N.	M.V.	Series 3.	N.	M.V.
C.	8°23′.6	4	51′	8° 3′.8	4	6′	6°17′.8	4	42′
E.	8°59′.7	4	25′	10°24′.7	4	34′	8°52′.1	4	39′
P.	11° 0′.5	4	67′	14°41′.8	4	49′	9°20′.3	4	92′
Av. and Tot.	9°27′.9	12		11° 3′.4	12		8°10′	12	

N. B. *White* threads were used.

TABLE XI.—BLUE SQUARES ON YELLOW. V. D. = ½ IN.

Observer.	Series 1.	N.	M.V.	Series 2.	N.	M.V.	Series 3.	N.	M.V.
C.	8°41′.8	3	49′	8°33′.5	3	30′	4°36′.4	4	99′
E.	6°57′.	4	11′	5°57′.2	3	78′	4° 4′.2	4	13′
P.	7° 8′.7	4	43′	6°59′.7	4	44′	2°30′.7	4	44′
Av. and Tot.	7°35′.8	11		7°10′.1	10		3°43′.8	12	

TABLE XII.—RED SQUARES ON GREEN. V. D. = ½ In.

Observer.	Series 1.	N.	M.V.	Series 2.	N.	M.V.	Series 3.	N.	M.V.
C.	3°56′.	3	71′	5°38′.8	3	47′	3°31′.5	3	23′
E.	1°56′.4	3	18′	2°49′.3	3	35′	2°37′	3	10′
P.	4°16′.2	4	36′	4°39′.9	4	43′	4°10′.1	4	67′
Av. and Tot.	3°22′.8	10		4°22′.6	10		3°26′.2	10	

[1] The angle here given is the average of all normal observations. See Table XX.

TABLE XIII.—COLORED MEDIA.

Observer.	Normal Series 2.	N.	M.V.	Red.	N.	M.V.	Yellow.	N.	M.V.	Blue.	N.	M.V.	Green.	N.	M.V.	Smoked Glass.	N.	M.V.
C.	12°51′	6	16′	11°49′.6	3	37′	11°17′.8	3	65′									
E.	12°16′.7	4	18′	13°45′.4	4	49′	12°10′.6	4	31′	15°22′	4	78′	12°18′.3	4	29′			
P.	16°50′	4	31′	13°44′.4	4	50′	15°11′.4	4	32′	15°42′.8	4	46′	15°59′.6	4	50′	9°23′	4	86′
Av. and Tot.	13°59′.2	14		13° 6′.5	11		12°53′.3	11		15°32′.4	8		14° 8′.9	8				

TABLE XIV.—NORMAL. VARYING INCLINATION TO LINE OF VISION.

Observer.	30°	N.	M.V.	45°	N.	M.V.	60°	N.	M.V.	90° Normal.	N.	M.V.
E.	5° 8′	2	16′	4°41′.7	4	99′	8°52′.1	2	18′	13°17′.1	4	27′
P.	11°37′.8	2	20′	12°25′.8	4	68′	13° 7′	2	4′	17°10′.2	4	2′
Av. and Tot.	8°22′.9	4		8°33′.7	8		10°59′.5	4		15°13′.6	8	

Tables X., XI. and XII. present interesting variations of color. In Tables X. and XII. the various series show in general the same direction of increase and decrease as did Tables II.–VI. above. In Table XI., series 2 is slightly less than series 1. But the point to be noticed is the universal decrease in the amount of the illusion, especially in Tables XI. and XII., where colors are used. Many interesting color combinations suggest themselves for similar experiments, but these were deemed sufficient to make clear the great changes produced by the introduction of colors without alteration of geometrical form.

Table XII. gives the records obtained by viewing the 'normal' form through variously colored gelatine papers. A comparison series taken at the same time is given at the left. The table shows nothing decisively. There is a general tendency towards a diminution of the illusion, especially in the one case where smoked glass was used. Observer E., however, shows a constant tendency to see the illusion increased. Careful questioning at the time failed to elicit any reason for this, but I suspect that E. was influenced by the greater ease of measurement here. For under these conditions the deflection of the line seems to be more constant and to extend more to the line as a whole.

Table XIV. shows that the illusion is greatest for two observers when its plane is perpendicular to the line of vision.

TABLE XV.

Observer.	Fig. 14, *a*.	N.	M.V.	Normal.	N.	M.V.
E.	10°24′.7	4	41′	13°17′.2	4	27′
P.	11°31′	4	69′	17°10′.2	4	2′
Av. and Tot.	10°57′.8	8		15°13′.7	8	

TABLE XVI.

Observer.	Fig. 14, *b*.	N.	M.V.	Normal.	N.	M.V.
E.	11°41′.2	4	31′	13°17′.2	4	27′
P.	15°47′.5	4	23′	17°10′.2	4	2′
Av. and Tot.	13°44′.3	8		15°13′.7	8	

TABLE XVII.

Observer.	Fig. 14, *c*.	N.	M.V.	Normal.	N.	M.V.
E.	8°43′.5	4	38′	13°17′.2	4	27′
P.	13° 0′.3	4	44′	17°10′.2	4	2′
Av. and Tot.	10°51′.9	8		15°13′.7	8	

TABLE XVIII.

Observer.	Fig. 14, *d*.	N.	M.V.	Normal.	N.	M.V.
E.	4° 7′.7	3	2′.8	13°17′.2	4	27′
P.	3°57′.2	3	27′	17°10′.2	4	2′
Av. and Tot.	4° 2′.5	6		15°13′.7	8	

N. B. Threads 3 in. apart.

From Fig. 14 it will be seen that various geometrical shapes may be used to produce the illusion, the 'wriggling' character of which in this case is due to the reversal of the figures at *b*, the lower being here upon the left. Tables XV.–XVIII. refer to experiments made upon figures composed each of six pairs, in the form respectively of *a*, *b*, *c* and *d*. The comparison column of 'normals' was taken at the same time and with all conditions identical except that of form.

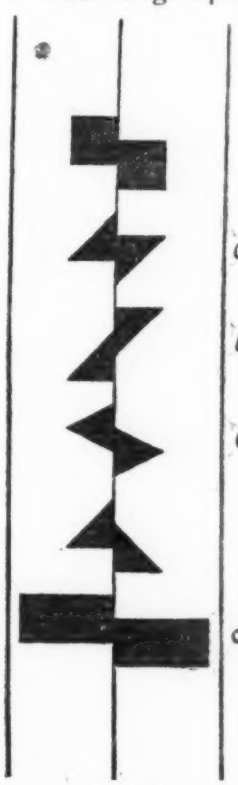

FIG. 14.

In Figs. 14 *b* and 14 *c* the 'irradiation angles' are respectively 135° and 116°+. It is interesting to note that these odd forms give a weakened illusion; also that the particular distribution of black in Fig. 14 *b* gives an illusion greater than that in Fig. 14 *c*, although its 'irradiation angle' is greater. A lateral increase of dark area strikingly reduces the illusion, the records of Table XVIII. being the smallest that we have anywhere encountered.

TABLE XIX.—COMPARISON TABLE OF 'NORMAL' FORMS.

Character of Figure.	Observer. C.	E.	P.	Averages.
Typical form. Fig. 2	**12°51′**	**11°56′.4**	**17°19′**	**14° 2′.1**
White squares on black	8° 3′.8	10°24′.7	14°41′.8	11° 3′.4
Blue squares on yellow	8°33′.5	5°57′.2	6°59′.7	7°10′.1
Red squares on green	5°38′.8	2°49′.3	4°39′.9	4°22′.6
Middle line heavier	8°44′.3	9°38′.8	11°48′.7	10° 3′.9
Normal through pinhole . . .	4°33′.8	9°40′.9	14° 3′.7	9°26′.1
Through colored media	[1]11°33′.7	13°24′	[2]15° 9′.5	
Electric spark	9°33′.4	7°11′.8	8°57′.3	8°34′.2
Fig. 14a		10°24′.7	11°31′	10°57′.8
Fig. 14b		11°41′.2	15°47′.5	13°44′.3
Fig. 14c		8°43′.5	13° 0′.3	10°51′.9
Fig. 14d		4° 7′.7	3°57′.2	4° 2′.5

In Table XIX. are collected for convenient comparison the results of experiments of the 'normal' form, series 2, under the twelve conditions indicated at the left. The often striking deviations from the typical form require no special emphasis here.

TABLE XX.—GRAND AVERAGE OF 'NORMALS,' FORM OF TABLE III., SERIES 2.

Observer.	Normal.	N.
C.	11° 5′.2	25
E.	12°14′.6	26
P.	16° 8′.6	40
Av. and Tot.	13° 9′.5	91

Finally, Table XX. gives the grand average of results from the typical figure, gathered from the various control experiments of the different tables. The final average, 13° +, may be taken roughly as the probable measure of the illusion under most favorable conditions. But there is no wish here to insist upon absolute numbers, for that would involve both a consideration of our ability to establish parallelism between lines and a discussion of discriminative sensibility for angular magnitudes—matters which must remain unconsidered here.

[1] Red and yellow only.

[2] Smoked glass not included.

The illusion under discussion has now been subjected to both a qualitative and a quantitative examination. The former has shown us that whenever irradiation is excluded the illusion vanishes. The latter has shown that whatever alters the amount and character of irradiation produces an alteration in the amount of the illusion, as conveniently seen in Table XIX. If now we combine these two lines of evidence, the conclusion seems irresistibly forced upon us that irradiation, and that alone, is adequate to explain the phenomenon of the Münsterberg illusion.

ON THE PSYCHOLOGY OF RELIGION.

BY HIRAM M. STANLEY.

In this paper we wish merely to record some thoughts with reference to a psychological definition of religion, and to offer some remarks upon religion as biologic-sociologic function.

A remark which may well serve as a starting-point toward definition we extract from Hinde's recent valuable work, 'The Fall of the Congo Arabs:' "Several people came to me with stories of having been called or attacked by an invisible being; and one case in especial I remember of a soldier who came with his sergeant, Albert Frees. This man declared that towards evening, while sitting with three or four people round a fire, a 'thing' which he could not see had come up behind him and had smacked his face and boxed his ears. He wanted to know if I could catch the spirit for him, for if I could not, he said, he would surely die" (p. 199). We notice here that this African savage believes himself hit by a 'thing' who struck him and might be caught. This incident shows well the psychology of the savage religion as contrasted with the civilized interpretation. The author, indeed, from his point of view calls the being which struck the savage 'Spirit,' an immaterial or at least extremely tenuous reality, and yet at once contradicts himself by calling it by the savage's own appellation 'thing.' The actual consciousness of the savage is then quite different from a civilized man's inevitable interpretation of such an occurrence. And this is a typical case, which might be multiplied many times, of the observer's using wrong terms so as to convey a wrong impression of the actual *status* of the savage mind. And how easy this is may be seen again in a specially marked way in Lubbock's 'Origin of Civilization and Primitive Condition of Man' (p. 159), where he gives an instance showing that the Australians do not interpret any beings as spirits, and yet he immediately thereafter ascribes to them a 'dread of evil spirits.' Certainly one of the greatest hindrances to learning the facts of savage psychology is just this, that the observer interprets by advanced conceptions.

That the savage does not conceive deity as a spirit might be illustrated from many observations, but it will be sufficient merely to add one or two records from Miss Kingsley's recent admirable book on West Africa. Thus (p. 447), she remarks that the savage Fans consider 'the blood the spirit;' and so again (p. 467) that they identified the liver and lungs as the witches. Of course, it is quite contradictory in Miss Kingsley to speak of the blood as the 'spirit,' and quite misrepresents the savage, who merely means that the blood is the real animating thing. The blood is the real personality and life which make man what he is. Where animism is in full swing in the lowest savage life, neither 'thing' nor spirit, soul nor body, have been conceived, but the total of presentations are personal beings or potentially so. However, thus early the savage wakes to some distinction of reality and appearance, as when blood is considered the essence of the individual man.

The objects of reverence and worship, *i. e.*, the deities, in the earliest religion are not then 'spirits,' a conception far beyond the savage mind, but merely superior animate beings. Some of these beings are more shy and distant than others, and are rarely seen, but all lead an existence perfectly analogous to the human kind. Some (Kingsley, 459) can be seen only by the gifted. It is a mark of superior persons, human and ultra-human, that they keep themselves aloof, and are communicated with only in special ways. So the king retires to his palace and must be conversed with through his minister, and the deities retire from common sight, or to inaccessible mountain tops, and must be reached through their ministers. Powerful enemies, human or other, craftily hide and destroy, when unseen. Religion, though it early comes thus to be a relation to little seen or unseen beings, is not a relation to an invisible and much less to a spiritual being. And similarly primitive religion is not a doctrine of the supernatural, for the natural and supernatural have not yet been distinguished in the savage mind. The world is simply a kingdom of substantial personal beings of many powers and ranks, and supernaturalism and spiritism are unknown conceptions.

We must then consider such a definition of religion as Mr. Tylor's, namely, that religion is 'belief in spiritual beings,' as

very imperfect. In fact, religion in its primitive aspect can neither be defined as having to do with 'spiritual beings,' nor yet as 'belief.' Religion is no more a matter of belief with a savage than his relations with his brothers and sisters, but is equally matter of fact. He does not believe in the existence of his gods, but has had some direct dealings with them through his senses, has seen them with the eyes or through dreams—equally good methods—has felt or heard them. And he knows a great deal about them from the testimony of his friends and from the sorcerer. If connected with shadow or breath, the deity is yet real and animate being. And so, seeing beings, in sleep or in trance, he does not see, as Tylor calls them, 'spectral beings,' but corporeal realities. What the savage sees in dreams are not ghosts nor spirits, nor souls, but flesh and blood realities in another than the waking world. Indeed, for the savage there is a confused unity, actual here and now, of all the living beings which constitute the manifold world. The dream world is as definite a part of corporeal actuality as the waking world and directly connected with it.

So, again, we miss in Tylor the true standpoint of evolutionary psychology when he defines (Primitive Culture, II., 108) 'spirits' as 'simply personified causes.' This is looking back upon the savage mind through our own notions, rather than placing ourselves back in the savage *status*. The savage does not 'personify' anything; the world, for him, simply consists in a multitude of personal beings. And 'cause,' as thing which may be personified, does not exist for him, and is only gradually evolved in later mentality through depersonifying of actions.

We must, then, deny to the primitive savage animism any sense of the spiritual. The savage world is wholly composed of substantial persons, and thus, if religion be a relation to the spiritual, perceived, felt, and acted on, then this stage of mind is religionless. But if religion be what we take it to be, the reverential, worshipful attitude of mind, the savage certainly shows this mood toward a large variety of what we would call 'things,' but which are to him persons.

If the primitive nature of religion, and so a full definition, is not to be sought in a doctrine of spirits, we must search else-

where. And it is obvious at once that religion is a mode of psychic relation to superiors. We know that a distinct note of mentality adaptive to superiors is early forced upon living beings by the stress of existence. It is most essential to any animal that it should recognize that which is greater and more powerful than itself in its environment, and should act conformably. Thus arises simple fear as the earliest emotion, and the animal is enabled to get clear away from the destructive being. Hence, in the simplest form of existence, the animal responds to elements in its environment in a twofold manner: if the element is superior, by flight, if inferior, by fight. But with some vastly superior beings in its environment it becomes of more advantage to propitiate than to flee, to get their good will and help by worship, than vainly to attempt escape beyond the sphere of their influence. Thus it happened at some critical period in its existence that some exceptional animal attained this useful variation—worshipful action—through attaining that psychic mode we call religious emotion which prompts this action. This emotion, with its expression, secures the advantage to the vastly inferior of tolerance, and even of aid, where it would otherwise be crushed by omnipotence. And the very high being becomes more and more susceptible to such approach, and the very low assiduously cultivates it, so that the most worshipful inferior comes off best in the battle of life.

Now, the propitiatory attitude was undoubtedly first prompted by a modification of fear. Fear becomes modified by a tone or mode which we call religious, and which cannot be closer defined, but only recognized in introspection for what it is, a worshipful fear. Fear here does not turn from its object, but toward it, and approaches it (deity) in reverencing in abject homage.

And it certainly seems likely that this reverencing fear for vastly greater beings appears amongst lower animals. To worship, to propitiate is a mode of utility comparatively simple. This tendency might be expected to appear in the relation of domestic animals to man, and, indeed, in many cases the dog seems to regard his master as his god, and to have a truly religious feeling for him. Indeed, religiousness is the chief element in the dog's success in the struggle of existence. Man

selects the most religious dogs, and the dog in large measure owes his continuance and existence to his faculty for a willing and absolute devotion, where fear at length becomes replaced by love. I have also seen a small dog cultivate the friendship of a large dog by acts which indicate a profound submission and reverence.

In pursuing the psychological definition of religion we have necessarily been led to notice its genesis and function, for it is obvious that this definition must be inclusive of the most primitive forms. We take it then that religion must be biologically defined as a specific mode of reaction to high superiorities of environment, or psychologically as a perception of a highly superior personal being, leading to a peculiar mode of emotion and will toward that being, and thus securing the most advantageous action. And religion is primarily the emotion, for that gives the peculiar coloring to perception and will as elements of the emotion itself which is the religious quality; that is, it is plain that mere perception of superiority *per se* or mere will action *per se* towards the superior does not make religion. The reverential and worshipful emotion spent is the essence of religion, and wherever this is found among the lowest animals or the highest specimens of mankind, there is religion.

In regard to the psychological definition of religion as the worshipful attitude toward superiority we must note that this is vastly wider than the historical definition. In fact it includes what often appears mere metaphor, as when we say of a man that money is his god, for in reality the man having a reverence for the superior power and value of money as supreme, and being devoted to gaining money, has the real religious consciousness with reference to money. And so with the worship of art, Heine prostrate before the Venus of Milos too shows real religiousness, or certainly as near to it as that sardonic spirit ever attained. Whatever appears to be supreme, absolutely and really, excites religion. Hence it happens that no earnest-minded man is without religion. Religion, however, as a mode of consciousness, cannot belong to the utterly selfish, for self-worship is a contradiction in terms, no man ever appearing as a real objective superior to himself. It is to be noted that in

some extremely late forms—as in the worship of art—reciprocity, which is so strong and vital an element in religion in general, is lacking. Or is such a form only *quasi* or *pseudo* religion, that is a form of deeply instinctive feeling which is transferred to an unreligious object, and so, though having a certain religious quality, yet is largely fictional? But it is a difficult point of psychological analysis which need not now be pursued further. Again, we must note that by the psychological definition of religion as the form of emotion toward superiors it results that when deities are approached in other than the worshipful spirit we have no longer, strictly speaking, religion. Thus the savage who becomes angry with his deities and punishes them, or enslaves them by fetish, thereby makes them inferiors, and real religion as psychological element disappears. The savage as wild acknowledges no superior, and his misfortunes awaken in him only common fear and anger, but he endeavors to get into his own power the good and bad agencies—human by witchcraft, ultra-human by fetish, both meaning the same in psychological attitude—by a cunning method of ensnaring and charming which is far from being prompted by religious emotion. Fetish as deity-compulsion is thus non-religious. This getting the upper hand of a deity by trick, either to drive off evil or make him a servant, is peculiarly a savage conception. Yet magic and worship, threat and entreaty, are apt to mingle, revealing the crudity of the religious conception, and how far the savage mind is from that sense of an absolute superior which engenders the truest and deepest religion. The ultra-human beings whom the savage perceives, and seeks to make his friends, or at least drive away if inimical, are plainly of the same order as the human beings by which he is surrounded, and so he feels and acts toward them in precisely the same way. Hence it cannot be too often emphasized that there is no peculiar mode of feeling toward the ultra-human, but religious and non-religious feelings are equally related to both the human and the ultra-human neighbors. Psychologically the worshipful feeling is the same whether it be directed toward the human superior, or toward the beast, or mountain, or storm, or any other being.

With this psychological definition of religion we now proceed to note some points with reference to its function in some of its evolutions in mankind.

With primitive man religious perception—emotion—action is certainly more conspicuous than with lower animals, and is especially to be noted in the family relation as fulfilling an important function. The child looks up to the father with religious awe and reverence, and all patriarchal society receives a strong *impetus* from father-worship and ancestor-worship. Thus is a central and conservative authority established and maintained, and thus it comes that the most religious families and clans have a large advantage in the struggle for existence by reason of their unity of action thus secured. And whether the highly superior being as father and ruler be dead or alive matters not in the religious attitude. The ancestor is always equally alive, whether in this world or the other, which is in direct communication with this, and the homage, offering, prayer, which is given is psychologically identical in both cases. Here then is a socializing force of the first magnitude by which the family tie is strengthened and greatly enlarged, and, indeed, in China embraces a nation. But patriarchalism, in which this form of religion plainly has an important function from the beginning, is only a crude method of socialization, soon culminating, and it must be said that the family spirit in modern civilization and administration is very largely retarding, it being the spirit of dynasty, of nepotism and of all narrow separative clannishness. And even ancestor-worship at its best is limited to keeping up the *status quo*, and society is bound to the ways of its fathers. Progressivism is frowned upon, and the best fruit of such a system is merely China. Indeed, ancestralism would not give a new variation a fighting chance, and it is largely in spite of the ancestor-conservatism that China attained even its measure of civilization through its sages and heroes. Christianity, by universalizing and idealizing the family conception to mean the brotherhood of man under the fatherhood of God, is not expansion and cultivation of familism—ancestralism, as might seem at first sight, but is really its destroyer in its leveling force and cosmopolitan reach.

But other forms of worship than that which arises from the natural superiority of the father are apparent in early man. Any immense superiority in strength or valued ability, or any marvelous exploit, especially as saviour of a community or tribe, leads to hero-worship. And here, again, it is a matter of indifference whether the hero be dead or alive, as we express it, but by a conception foreign to the savage. The same feelings and acts exist equally in both cases, for to the savage mind death does not mean any such separation as to the civilized, but merely a new state of existence, but still in the world. And in the natural evolution by utility the value of this form of religion is equally apparent with father-worship, as a socializer, and as setting example for heroic endeavor of all kinds. And hero-worship is still a very notable element in human society. Genius-worship is common, and many men and women reverence and adore some great personality of times present or times gone by. Thus I have seen a boy fairly worshiping an athlete exhibiting at a show. Men under plutocratic democracy often worship the very wealthy. Saint-worship is also a form of hero-worship. But this form of religion evidently finds its culmination in Comtism, or the worship of humanity as a whole.

But the worshipful feelings and actions are early attached by men, not only to men in various capacities and states, but also to a vast variety of other personal beings, many of which have been entirely disbelieved in or forgotten by later generations, or else have been quite depersonified, and so, since worship is a personal relation, made incapable of being worshiped. For instance, the small-pox deity is especially prominent with savages afflicted with this disease, and so the offerings and observances to appease this god; but with civilization and vaccination a special deity as inflicting this evil is entirely done away in the minds of men, and by so much religion is quite dissipated. Now, while it is obviously easy that the religious tendency should attach to such very superior power for harm as small-pox, it is also plain that this religious mentality has no utility, but rather quite the opposite, in that the offering is waste of substance and energy, and that the contagion is spread by religious assemblies. And yet for centuries the theistic theory

and treatment of this and other diseases has held sway or been used to some extent, and is even now in use to some extent, with many civilized people.

A doctrine of utility cannot then explain the rise and growth of religion in this form, nor of any such demon or deity worship, quite in contrast to ancestor and hero-worship, which have plainly sociological utility from the first. In a purely natural evolution every variation is fixed and developed by reason of its utility in the struggle for existence, but here in this religion of disease-deities, and in many similar forms, we can trace no utility, but quite the contrary, and yet such religion has been a prominent and persistent character in humanity. The most successful tribes and peoples are those least imbued with religiousness of this type, as the Fans of West Africa, noted by Miss Kingsley. How is it, then, that in natural evolution a directly harmful psychic variation, which is not even imperfect adaptation, can be seized upon and developed, as this religion in manifold ways has been? The law of utility certainly seems to fail here, and yet the religion of deities controlling rain, disease, etc., has had a wonderful development.

Again, religion is a peculiarly baffling phenomenon not only as in the main contrary to the law of utility, but also as contrary to the law of increasing specialization. In its order of evolution it seems to reverse the usual order from the simple to the complex, and from the generalized form to the specialized. Religion in its earliest stages is a complex polytheism manifold in its beliefs and practices, which gradually simplifies into monotheism and pantheism. And it can hardly be said that religion is, unlike art for instance, a factor which culminates early, and theism and pantheism are but decadent phases, for it is obvious that the completest and deepest religion lies in these latter forms, as for instance in a John Bunyan or a Madame Guyon. Before the search-light of science the gods have fled, but not religion. Religion is not to be measured by the number of deities; in its polytheistic stage it is after all only in the lower organization of a milliped, which is later to become biped and monoped.

Religion then as a mode of feeling and action toward highly superior beings has only in a few forms and in a limited way a

raison d'être for the evolutionist, and its whole process of growth seems contrary to accepted laws. In such an ancient form as religion acting with reference to bringing or averting rain—a form by no means yet extinct—we see a persistent and entirely futile method which science is tempted to call a disease of the human mind. Religion in most of its forms may be accounted an aberration of perception, judgment, feeling and action, a groundless other-worldliness which is distinctly a hindrance in the struggle for existence, a false dependence upon that from which no help cometh. Thus man by appealing to the rain-god, instead of using scientific means to promote rainfall or to supply lack by irrigation, has hindered his development for centuries. A purely naturalistic and scientific view of fetishism, religious or unreligious, must emphasize it as not only very useless, but also very harmful. It is likewise obvious that the whole history of prayer for outward results—so dominant in early religion, and appearing as a large element in later religion—points to this fundamental religious element as throughout useless and harmful. Prayer is instinctive in times of extremity—often cursing with men, imploring with women—and yet it is obviously very disadvantageous to make men other-reliant in such circumstances. Absolute stolidity is more favorable in general, and an intelligent watch and endeavor always more useful. In fact, the critical circumstance is just where the evolution to highest forms of intelligence and action is evoked in natural evolution, and thus the prayer method is distinctly anti-progressive. The same, of course, may be said of the sacrificial gift, and also of the religious resignation and fatalism which accepts all occurrences as the inevitable decree and will of Deity. But in the highest civilization to-day 'acts of God' are unrecognized; but accident, disease, etc., are laid to human responsibility, as in lack of caution or of use of proper means. Hence, looking at this religion as a function in the development of humanity, its utter inutility for the ends it proposes to itself seem obvious, and yet science is puzzled to understand how so persistent and important an element could maintain itself without some real functional significance. But as it is, science finds in religion a method in humanity comparable to the finding a

method of permanent fin-form and activity in fishes which should retard swimming, or a kind of leaf on trees which should hinder circulation and respiration. In short, we come back again to the question how science should account for a disadvantageous organ in humanity.

But it may be said that, though early religion does not secure the ends it immediately aims at, it secures incidental social advantages which have served to perpetuate it, harmful error though it be. And we have already admitted a certain gain in socialization in the ancestor and hero-worship forms, but can we admit it for other forms which constitute so large a portion of religion? Though we have already remarked on this, it may be well to add somewhat on the biological-sociological theory of religion, as such a theory maintains that the most religious tribe, while not specially free from disease and favored by climate through its religiousness, yet is favored in the struggle for existence by its religion giving a superior unity of effort, a cohesiveness which makes it victorious against its enemies and successful in all united enterprise. But is it a fact that the more religious a tribe the more successful it is? For instance, Miss Kingsley clearly shows that the Fans, though they have comparatively little religion, yet are the dominant West African people, while many of the weaker tribes are excessively religious and are even used as proxies in religious matters by the Fans. It may often be shown that weakness finds its final resort in religion, and that the weak, by relying on a superhuman aid that never comes, but make their weakness weaker. It certainly yet remains to be proved that religiousness is an index of prosperity, that is of the worldly success which natural evolution alone recognizes. The social theory of religion is certainly carried very far by some writers who make religion to be the originator, maintainer and developer of society, the very source and mainspring of all socialization. Socialization certainly begins with headship, authority, superiority, in a man founding a family, and in the course of the fatherly function religious reverence and fear arise and are stimulated by the father, and constantly strengthen by action and reaction, and so the patriarchal tie of early society is strengthened. But the religion

begins from the father-ruler, that is the deity himself, and thereby enforces his authority. Religion certainly does not originate society as the family, but it very clearly appears to strengthen that socialization by house-father reverence, patriarchal clanhead reverence, and the continued worship of these as ancestors when they have passed away to a higher life. It is the superiority of might which founds early societies, as family, clan and patriarchal government, and impresses the governed in such a way as to call out the religious sentiment and action as devout allegiance to the head. Thus religion is not originator, but a reflex and sanction of society. In some ways religion in its forms is, indeed, no more than imitator of social organization and powers already initiated and developed. For instance, the human sacrifice is doubtless derived from the time when the chief and father had full right of life and death over those under him. So patriarchalism in religious organization is doubtless but imitation of political and social patriarchalism.

Nor can we think that religion is the developer of society in promoting higher levels of socialization, but it seems more probable that the unifying into higher and larger groups was by other pressure, though when the group is once formed religion at once enters as social sanction. The main method of social extension in primitive society is by conquest, and the gods of the conqueror are naturally recognized by the conquered as the superior, and yet the conquest has little of a missionary nature. Of course, when a unity of worship is once attained by conquest or otherwise, this religious unity strengthens other unities and is a distinct helper to the further evolution of the group. However, unity of worship in early society is perhaps always brought about by foreign means, the missionary spirit being a late evolution in religion. Religion at first is a purely family and clannish affair, a matter of inheritance with reference to common ancestors and heroes.

Religion, then, though it must be granted a place as socializing force, can only be allowed a secondary and inferior place. It is very singular that religion must be self-deceived in order to be useful, that its direct ends it never attains (that is, with reference to deities, but what we now term the supernatural), the

whole value is as social tie rather than, as it supposes itself to be, tie to deity. Religion for sociology is thus a unique factor which fulfils itself only incidentally. Thus science views the function of the prayer assembly for rain not in the bringing rain, but the assembling as giving unity of spirit and action, and thus preparing for more practical activities. Religion, then, for science appears to have its real validation for its existence not in promoting a unity of man with hypothetical deity, but of man with man. Religion, unknowing to itself, is only a useful fiction. And the remarkable thing is that when it comes to be directly cultivated for its social function, it loses its power; for it is obvious to all that religion which in decadent and formal way is practiced purely in order to maintain social unity and order, as often in state churches, loses its vitality and real unifying power. But this, in my opinion, merely indicates that the biologic-sociologic point of view errs in making religion arise and develop primarily yet incidentally as social organ. And it must be noted that religion is now and always has been intensely conservative and divisive. Religious dissension and variance have kept men apart more than, perhaps, any other factor, and religion must thus be placed at the head of the anti-socializing forces.

But it may be said, as with Mr. H. R. Marshall (see Mind, Vol. V., p. 367 ff.), that what makes religion a prime socializing force is that it represses individualism, in promoting submissiveness to authority. We have already noted this value and its limitations, and we must note that the method of socialization thereby maintained is only the earlier and lower form of the tyranny and despotism of absolute monarchy and the 'divine right' of kings. But the higher socialization has been founded on an incessant fighting against and throwing off authority, and making it possible for the individual in the free fulfillment of himself to satisfy the rational demands of society. Religion has been in the early evolution of society entirely on the side of authority, and in later evolutions mainly so, for, though the doctrine and sentiment that all men are equal before God has in Mohammedanism and Christianity a certain democratizing power, yet practice has little heeded it, and religion

takes advantage to draw all men under its hierarchy. But to-day religion itself against its will tends toward individualism; it ceases less and less to be a social-political force, and becomes a matter for the individual alone, his own private affair. But although the state and all social activities receive less and less *impetus* in an organized way from religion, yet socialization is going on, and on a larger scale than ever before as incited mainly by commerce, industry and science. The wonderful complex socialization of our day certainly owes little to religion, and religion in its forms of outward activity—societies and organizations—has scarcely kept up with the specialization in other culture factors, while in its inward development it seems to have lagged far behind.

Religion, it may be said, represses individualism specially by seclusion and hermitage. But it may be asked how the withdrawing of individuals from society into solitary self-abnegation contributes to sociality. Is not religion in fact divisive in setting up here, as indeed everywhere, its world against the world, the sacred against the secular? Further, the motive of hermitage, whether it be desire for personal holiness or to receive the homage of men as being a holy one or saint, is individualistic, though in later form slightly socialistic. So also fasting and mortifying the body by torture, etc., are certainly weakening to the individual and make him more dependent on society, but only thereby weaken society, which loses so much of strength and ability; and further the motives, desire for holiness and homage of men, are individualistic. Prayer as religious practice, while obviously a suppression of individualism as self-help and self-reliance, yet is used in early religion mainly for individualistic ends. And it is plain that by the turning away from fellow-men to a deity for help there is so much loss to sociality. Thus the theological and prayer treatment of disease brought very little socialization compared to the vast specialization under the naturalistic method whereby we look to scientific specialists in the medical profession, rather than to a deity directly or indirectly. Religion by these practices sometimes promotes mere aggregation or herding, as the pilgrimage, but has very little effect on organization. Social monasticism, indeed, organizes,

but mainly in an unprofitable other-worldliness which is a distinct hindrance to real general socialization. Further, religion, by suppressing and limiting wants through fasting, celibacy, seclusion, etc., really makes the individual more individualistic or independent, whereas civilization as socialization is an indefinite multiplying of wants which can only be ministered, not by man-to-God service, but by man-to-man service. The most dependent member of society is not *per se* the most religious, but the most specialized for his very definite and limited function, *e. g.*, the garment cutter who cuts only waistcoats. We see then that religion as far as it suppresses individualism is not specially helpful to socialization save in the earliest phases where association under chief, leader and king, is thereby stimulated. In later evolution it has been largely a hindrance to cosmopolitan organization. Personal devotion which partakes of veneration has, indeed, always been a considerable socializing force and yet a crude one, leading principally to a mere massing or aggregation around a head and to impulsive rather than rational activity.

But religion is chiefly a hindrance to progressive socialization by reason of its suppression of individualism by its inherent conservatism. It throws a halo of sanctity over the past. Radicals are very rarely extremely religious. And yet we may grant that in exceptional instances, as Mohammedanism, the religious radical inaugurates a higher socialization. But religion is mainly a conservative factor. In truth the freest and fullest individualism is alone compatible with highest—*i. e.*, most plastic and adaptable—socialization, and the individual is only made able to realize himself in this free society. Individualism only opposes socialism on the lower levels of social evolution. And yet socialization as continuously increasing must arise in variant action, *i. e.*, radicalism. Individual initiative breaks with hallowed conventions and stimulates new and more advanced socialization. Religion has no doubt a function as a necessary brake on the car of progress, and yet it has often held men in a needless bondage to the past. Of course, religion has its own radicalism, but, as in our own day, this is largely due to outside influence. Religion has progressed not so much

by its own *momentum* as by a push from without. Religion thus adapts itself to every age, but is rarely if ever the leader of its age in socialization.

It seems, then, from many considerations highly probable that objective social utility is not the prime motive and function of religion. The original centralizing and organizing force was undoubtedly war, defensive and offensive, and secondarily competition in trade and the arts, and these have remained paramount socializers in human history as a whole. But the relation of religion to public and private morality, if not distinctly initiatory and organic, is yet a sanction and *impetus* which must be noticed.

It is undoubtedly true that religion influences conduct—the action of man toward man—from very early times, and that not only in the specially religious way, as by priests and sorcerers, but in the ordinary activities of men toward each other. Thus, that the ethical feeling appears in very early religion is evident from Miss Kingsley's account of the Fans and other tribes. Thus man conceives that he pleases his God by certain actions toward his fellow-men, though these actions are as apt to be anti-socializing as the contrary. Religion increases man's enmities as well as his loves. We know historically that man feels the divine call to do the most varied kinds of actions by his fellow-men, often the most harmful and anti-social, as in religious persecution.

Ethics, indeed, appears to originate in religion, and is primarily the feeling of ought in response to command of high superior to whom allegiance and devotion is given. Thus arises the compulsiveness of duty as personal obligation and as obedience to a person. As deity becomes spiritualized and evanesces, obedience becomes depersonalized until an abstract moral law or an intuition takes the place of lawgiver, and thus religion vanishes, or by larger definition develops into an individualistic moralism. The 'moral law' within is thus a distant evolution from the command of high superior, and the 'voice of conscience' is the ghost of the voice of deity. Moralism, then, is abstract religion. The ethical feeling as answer to superiority is a direct evolution of the religious feeling. If this natural his-

tory be correct, morality, as an obedience to an impersonal standard and as an ideal life simply for its own sake, is the highest fruit and culmination of religion, and is, of course, a socializing power of the highest import, though often indirect.

It must be remarked that though piety and duty have a distinct evolution they often interact. One may piously do his duty, or dutifully do his piety. But in any individual one tendency will be dominant, and moralism shows itself as the latter form.

If religion on the side of action develops into moralism, on the side of intuition and feeling it develops into myth and art. In the stories of myth and folklore the deities of the past become more or less inferior or fictional, and become the subject for art of every kind. Thus the Greek religion is æsthetically enjoyed to-day in a way quite impossible to its devotees in its strictest form as religion. Sacred art is, indeed, employed by religions, as, for instance, in the morality dramas and devotional pictures, but not in the purely æsthetic spirit. But for the purest æstheticism the subject must be entirely fictional and plastic. And so art gradually penetrates religion, and religion evanesces into art. Religion reaches its artistic stage in a high ritualism and symbolism. And in the end art is the embalmer of dead religions, or an ivy which beautifies their ruins. Religious emotion, like any other, come to self-consciousness and cultivated for its own enjoyability, becomes æsthetic. And art, proceeding from religion or otherwise, is plainly a great unifier and socializer. Art is fundamentally display to another, and thus socializes from the first and very rapidly throughout its whole course; while religion as primarily an affair between a man and his deity is not fundamentally social, at least in most of its phases as concerning ultra-human deities.

Religion, then, like other culture factors, while it begins as serving life, as a means or supposedly so in its own eyes to action, finally becomes, in art and morality, and also by itself, its purest form, an end in itself, and a life of its own, which, like music, requires not objective validity or function but merely subjective validity or function. Religion is true as music is true in being true to itself in its highest emotionality. As the

musical instinct and sentiment presses on self-guided and self-sufficient and wholly unhampered by objective guidance, but seeking only what pleases itself, and so freely incarnating itself, so also acts the religious instinct and sentiment in a precisely analogous manner. Thus, though religion in all its forms contributes more or less to social function, this is neither its incentive nor its validation, and a complete interpretation of religion from the biological-sociological view becomes impossible. The higher scientific point of view must regard the musical person and the religionist, like the lion or the palm tree, as truly natural living objects which represent certain modes of activity and experience which tend to become typically pure or entirely self-active, and so of individual significance. Of course, on a far larger scale than science can measure, far larger than life or society, we may believe all these individual elements of reality as religion and music, as also human life and society themselves, to be unconsciously coöperant in the unity of reality, but this is really a philosophical conception with which we cannot now deal. It is sufficient now to see clearly that social needs do not create and maintain religion, but that religion first arises in the objective requirements of the individual and gradually becomes solely minister to subjective requirements. And it is also evident that objectively religion has been in its main part as appealing to deities a failure, but subjectively it leads to indefinite satisfaction. Religion has succeeded in consoling and elevating the mind, but has failed to bring rain or cure disease.

It is an undeniable fact that religion in the restricted sense as god-consciousness tends to disappear in higher human evolution, that is taken as a whole, for in special instances, as already noted, there is profound intensification of this consciousness. With the Bedouin, many times a day does the god-consciousness with religious feeling and practice occur, while with most men in the stress and strain of the highest centers of civilization, the religious consciousness is a comparatively rare phenomenon. Men in modern scientific democratic civilization no more venerate either the men-like gods or the god-like men. In this civilization, art and morality, culture and conscientiousness become more and more prominent in life, and piety less and less. In

civilization also, superhuman personal beings or beings manifested in various phenomena are less and less thought of, largely because civilization is a self-reliant management of life through the control of means rather than having recourse to a deity. But while the consciousness of deity and its practical application as piety are greatly supported in the recent evolution of mind and life by art and morals, which by *devotedness* and *earnestness* proclaim still the essential elements of religious feeling, there is another aspect, a philosophical one, which psychology is bound to understand in relation to religion, and that is monism.

In the philosophic rationalistic stage as the latest to appear in the evolution of the individual man—religion and art being manifestly early in appearance in youth, and the philosophic tendency only appearing in mature life—the evolutionist must find the highest and truest level the human mind attains. And how does philosophy treat religion? Plainly enough it points out the impossibility of any such objective deities as religion assumes, and so destroys religion as tie to deity, an external personal being as deity. From the philosophic absolutist point of view a man cannot connect himself with any external supreme being, for that which is supremely superior to himself is merely the All in and of which he is, hence that which moves within himself has as high a value as anything he can find, and yet self-worship, as previously noted, is impossible. Yet it may be that human consciousness as realizing that it is not an alien and incidental part of the whole, but a vital part in the life of the inconceivable whole, realizes a certain religious feeling, though dim and vague. Herder's definition of religion is suggestive, "Religion is our intimate consciousness of what we are as portions of the world, of what, as men, we should be and do." So, also, is Schleiermacher's description. "Your feeling, in so far as it expresses the common existence of you and the all, in so far as you have the several moments of it as the operation of God in you, mediated by the operation of the world upon you, this is your piety." Thus is expressed a glad conciousness of being one with totality, at home with the universe, which is certainly akin to religion, though it is hardly

that conscious personal relation to a highly superior person which determines religion in general. But the monistic feeling is a real psychological phenomenon, and finds expression in a certain confident mode of action, a certain peace and trust, such as the 'love of God' of Spinoza, which is at bottom a determination of mind toward superiority. Though formally absolutism cannot constitute a religion, yet in spirit it may. The faith and trust in the unity of reality as a mental as well as material whole, and submissiveness thereto, may be accounted the least concrete and latest evolution of religion. The best fruit of this religion, as of all religion, is an altruistic endeavor and 'holy earnestness' which makes man honestly and patiently progressive in all labor, and brings him under a higher law than the struggle for existence. That is, in a considerable portion of the latter evolution of religion, especially in the artistic, moral and philosophical expansion, religion, as a matter of fact, appears no longer as merely a useful factor in the struggle of existence; it exists not for life, but life for it.

We come, then, to note—and science cannot but state the fact clearly and emphatically—that the religious view of religion in all its higher development is quite opposed to the biological-sociological. Though at first the god is for the man, in pure religion man is for the god. Religion claims life as its servant. All life is to be consecrated to the service of deity: to do the will of the divinity is the end of life. Thus the function of life is for religion, and not *vice versa*, as science would interpret. As is evident, religion, to be completely and purely such, to be an attitude of mind before supreme superiority, must make this interpretation, and give up absolutely in entire devotion. Religion is an interpretation of the place of human life as absolutely dependent upon deity, and to be entirely governed by deity. And science itself in its largest aspect sees clearly that biology is not a complete science, that is, that its subject matter as human life does not constitute a closed circle, as an organic whole of interacting factors, religion, art, etc.; but humanity is itself involved at every point in the larger whole of universal reality. It, therefore, contravenes a prime assumption of science, namely, the unity of reality, that human life should be isolated from the

rest of the factors of reality. But though the function of human life as a whole is undoubtedly a province of science, science has as yet been unable to make any such ready and full replies as religion gives, and so can at best sanction only a monistic belief and its vague trust.

Thus, though the science of religion necessarily regards religion as merely a human historic product, it need not affirm that religion in dealing with that which is beyond humanity is dealing with mere fictions, but regards the religious entities as very concrete but often misleading symbols of the higher reality in which humanity is embedded. Where science cannot now see its way it can only remain silently hopeful. On the other hand, we must say this, that science has done a great and good work in removing supernaturalism, in discarding demons and deities, and so displacing religion in many of its fields of knowledge and skill, and by encouraging self-reliance where once was only a futile god-reliance. And while science shows more and more fully the mighty superiority of the nature in which and of which we are, it aims not to interpret the parts by the whole, as in philosophy or theology, but only the part by the part in specialized piecemeal investigation. Nor can science *per se* encourage religious feeling toward this immense superiority; it is only eager to know and set down the relations existing in actuality from their own data, and all other emotion is distracting. But it is no disparagement to say of science that it is unreligious, or of religion that it is unscientific, and this only marks a necessary psychological distinction of one mood of mind from another. The scientific and religious emotions are distinct in kind, but not *perforce* contradictory.

Having thus made some inquiry as to the psychological definition and function of religion, we naturally turn to some considerations on the classification of religions. And at the outset it is plain that, though historically we may classify religion by object worshipped, as polytheistic, monotheistic, etc., this is no avail psychologically, for the worshipful emotion is identical whether toward one god or many, whether toward any object in nature, a plant, or an animal or any personally interpreted being. And if we take the broadest objective classification, that

into humanitarian religion and nature worship, we do not make any real psychic distinction. The adoration which a savage pays to his ancestor-god and to his rain-god appears to have the same psychic quality. The term nature religions does not mark a real distinction, because there is no such thing as 'nature' to the savage mind. His world is a vast congregation of interacting animate beings which are all akin, a star, a tree, a mountain, as well as a snake, a bear or a man. Thus, 'nature' religion simply means the worship of those objects which scientific people have come to demonstrate merely natural material objects, and so not to us worshipful, and thus implies no real subjective distinction in the original worshiper.

A method of genetic classification which has some psychological value would be distinguishing the stages of growth of the conception of deity in regard to its nature. First we note the earliest stages, when the deities are living beings in their directest, most immediate presentation, and as simple unities. The personal being is directly apprehended by sense, and directly worshiped, as, for instance, the slave worshiping his master, the vassal his chieftain. But it is soon noticed, as in the case of man, that the individual has several states, as waking, dream or trance, death states, etc. (Miss Kingsley found that the Fans had four), and worship comes gradually to be centered on the latter states, and through them the ancestor, etc., as deity is communicated with. But it is quite misleading, as we have previously set forth, to regard these states under the category soul; rather they are *alter egos*. The individual is polymorphic. The corporeal personality, however, returns throughout these migrations in its presentation reality. But a third stage notes that the body is a dwelling-place merely of a corporeal personality, indeed, but one very elusive and alert; and fetish, idolatry, and temple as residence of deity appear. Yet these deities may be seen and caught. However, the other-self is gradually sublimated into spirit. The rarely seen is thought invisible, but yet may be touched or felt, as in breath, *e. g.*; but finally all sensing of it is lost, and spirit or soul is conceived; *i. e.*, animism has evolved into spiritism. But while the intellectual content and interpretation of object has progressed from

gross sensation to apprehension of spirit, and therewith has gone some refinement of religious emotion, the progress of animism from spiritism does not mark any fundamental change in the essence of religion, that is in emotion. The worship of the corporeal being and that of the spiritual being may be, and often are, on the same plane, and identical in psychosis as emotion. The religious fear of a small-pox demon, whether interpreted as corporeal unity or multiform corporeal or as an indweller or as a spirit, is identical. Yet a being who is so powerful that, though he can in no wise be apprehended by sense, he yet maintains a great sovereignty, manifestly unites more worship and more profoundly than the being who is reached by vision or otherwise. Thus spirituality in general strengthens religion, though it may not alter quality.

Another form of psychological classification would be to divide religion according to the predominance of dogmatism, mysticism, ritualism and moralism. However, these are rather the forms of the evolution of any one religion, than distinguishing marks of religions. Every religion passes through these psychic forms in the course of its development. Again, as religion has been defined as a sentiment toward superiority, the stages in the sense of superiority certainly give the main points of the evolution of religions, marking the successive intensifications of the religious emotion. Emotion sublimated by the greatness of object is religious, and the degrees of sublimation mark the progress of religious sentiment. The esteem in which deity is held varies greatly, the god being in savage religion but slightly superior, while before Brahma the worshiper fades into a nonentity. But though a classification of religions from this point of view is a logical sequent to our definition of religion, yet it is a very difficult inquiry to measure the degree of intensification. But the psychological classification which will, I think, be the most fruitful is that which is based on the order in which the emotions become religionized. We have already remarked that fear is the first to become religious. And any emotion which is compatible with turning towards a high superiority may become religious, thus hope, love, faith, gratitude, admiring, wonder, etc. Of the negative emotions, hate may become

religious, but anger is hardly compatible with the sense of immense superiority which religion implies. The order in which emotions become religionized will probably be found to be the same as the order of the genesis of these emotions. It may be noted in analogy that the emotions in general become æstheticized; fear, anger, and all forms including religious emotion, come to be self-consciously indulged for their reflective enjoyment, as, for instance, fear very early is dramatically treated, and religion as well. And the æsthetic feeling itself may be religionized, the holiness of beauty and the worship of beauty being common. Thus both the worshipful spirit is felt æsthetically, and the æsthetic is felt worshipfully. And this is but a specimen of the complex interaction of emotions, a subject which has as yet received little attention.

In this outline sketch of a psychology of religion we have pointed out some difficulties, but the chief one remains to be mentioned, and that is, the lack of proper material. The explorer, missionary and scientific collector are rarely able to set forth clearly and fully the externals of savage religions, that is their objects of worship and religious practices, but as to the state of mind back of these externals we have almost no thoroughly reliable information. It would require a long residence with a people by an expert psychologist, and he would need to express his results through use of native terms whose meanings are made clear by description, and not through advanced conceptions and language, as 'soul' and 'spirit.' Miss Kingsley is a very earnest and conscientious observer, but her success was very partial, largely for lack of psychological training. And it must undoubtedly be recognized that certain *strata* of the savage mind are so remote from our feeling and conception as to be almost impossible of realization by even the most diligent and open-minded observer.

In this paper we have reached the definition of religion psychologically as the perception-feeling-will which characteristically expresses personal relation to a or the highly superior person, as contrasted with relation to inferiors and equals. Hence it is plain that modern civilization tends to eliminate religion in so far as science does away with the nature-deities or superiors,

and as democracy does away with social superiors. Religion, as we have sought to show, arose in the natural course of biological-sociological evolution as advantageous reaction, probably in family *status*, but was speedily extended to many relations to environment where it was unserviceable and even of disservice. In a very large part of its course, then, the growth of religion can hardly be explained either as a growth in social adaptation or in nature adaptation. Further, in the highest reaches of religion, as moral, artistic and monistic, the functional view fails because here religion as supreme lives by and for itself, and makes all its ministers. The evolutionary psychology of religion is then beset with difficulties, which must, however, be fairly faced and overcome before anything approaching a science can be constructed.

A SORTING APPARATUS FOR THE STUDY OF REACTION-TIMES.

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An important aid to the dissemination of interest in tests of mental processes would be the production of apparatus, simple in construction, inexpensive, and suitable for use by the inexpert; and to no group of mental processes is this more applicable than to those commonly described as reactions, and involving distinction and choice. Upon reflection it will be evident that a considerable portion of our mental operations is concerned with the detection of differences of kind and degree, and in the expressing or recording of our appreciation of such differences. A very large variety of actions, simple and complex, will readily conform to this formula. For example: in copying the various letters seen serve as the sense distinctions, and the various movements in writing them form the motor responses. In playing the piano the arbitrary marks on the sheet of music are the distinctions, and the combinations of keys struck form the responses. To the distributor of an outgoing mail at the post-office, the various addresses form the distinctions, while the response is the skillful throwing of the mail parcels into one of a large number of mail-bags, each bag representing a different mail-route. The study of the times involved in the various forms of these processes has occupied a prominent place in experimental psychology; and elaborate apparatus, both in the way of accurate chronoscopes for timing and of accessory apparatus for presenting the various stimuli and forms of responsive movements, have been devised. The provisions for repeating in a simple and inexpensive way typical experiments of this kind have as yet been somewhat inadequate, and it is with the hope of supplying in some measure this want that the apparatus here described has been prepared.

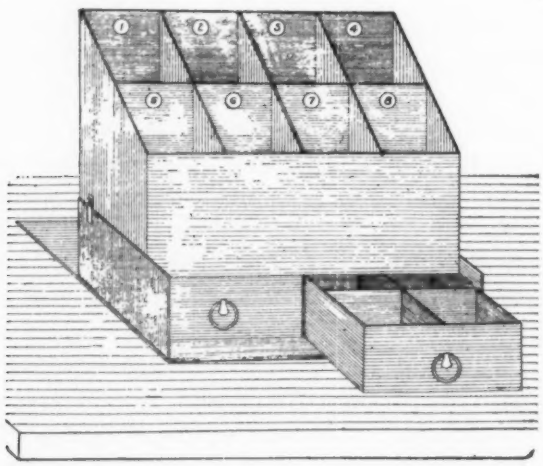
Inasmuch as the fundamental condition in such experiments is the timing, and inasmuch as accurate timing-apparatus is necessarily expensive, there seemed but one method of avoiding this difficulty, namely, to arrange the tests so that a relatively long period of time should be measured. And this in turn required that a considerable number of reactions shall be made consecutively, the measurement of time being that of the whole group as determined by nothing more accurate than an ordinary watch or a stop-watch. In testing a large number of individuals, each receiving a stimulus from his neighbor on one side and passing it on to his neighbor on the other side, the same principle has been utilized, and is called the chain-reaction. In adapting this principle to the requirements of a series of experiments upon the same individual, the process of sorting was selected as most adequately meeting the conditions; and the method to be described may, therefore, be called the 'sorting method' and the apparatus the 'sorting apparatus.' If, for example, one has presented to him objects of half-a-dozen different kinds and is required to take up each object in turn rapidly, to recognize it and to indicate that recognition by placing it in a designated place, it is evident that in each case he distinguishes the nature of such object and chooses the proper movement to indicate that distinction. The objects to be so distinguished must obviously be capable of being handled rapidly, the handling involving as simple a movement as possible. And further, the process must be such that each distinction and choice is made independently and completed before the next is begun. For these reasons as well as for general convenience there seemed nothing better than cards. Cards when accurately cut and highly glazed may be handled with great facility, and the possibility of presenting a variety of impressions on the face of cards is almost inexhaustible, while the sorting itself requires merely a suitable and compact series of compartments.

These conditions seem to determine the apparatus, but in the practical elaboration of the method a number of difficulties of detail were encountered. First, if the cards are held with the printed surfaces toward the subject, he sees the following card while still engaged in sorting the preceding one. To

avoid this, the pack of cards is uniformly held with the backs exposed and, as each card is taken up, it is turned over sufficiently to have the object upon it recognized and properly distributed. Again, a great many printed forms must be in the erect position to be familiarly recognized, and it would be a tedious process after a set of cards had been distributed to arrange them all right side up again before being able to pass on to the next test. To avoid this the cards have been cut not quite rectangularly, but with the upper side about one-eighth inch narrower than the lower. By aid of this device one need only hold the cards loosely and run the thumb and forefinger along the edges of the cards to lift out all those which happen to lie in an inverted position. The size of the cards was important; they must be small enough to be conveniently handled by most hands, including the probability that it would be interesting to use this apparatus with children; they must be large enough to require no very precise or delicate movements in taking them up. As a compromise the size was chosen of 77 mm. long, 50 mm. wide at the top and 52 ½ mm. at the bottom. Again, the back should be inconspicuous, not trying to the eyes nor readily soiled, and the surface be as smooth as possible. Inasmuch as the manufacturers of playing-cards offer the only facilities of securing such cards, these last conditions were extremely difficult to meet. It seemed unlikely, too, that the objects or forms which any one experimenter would print upon the cards would meet the needs of all others; and further, distinctions of color were quite certain to be called for, the expense of printing of which would be considerable. If, to meet these requirements, one were to paste and not print upon the surface the particular forms and colors desired, then a pack of cards so prepared would be much thicker at the centre and so make the handling of the cards awkward. A device was accordingly designed by which a small circle could be drilled out of the upper half only of the thickness of the card, thus providing a space in which any small form or colored paper or the like can be readily mounted.

For the sorting apparatus it was found desirable to provide boxes high enough so that when the card dropped in it fell completely out of sight. This was particularly necessary in case a

card happened to be placed in the wrong box, for it would then be seen in the compartment, and lead to confusion in the rest of the set. It was also necessary that each compartment should be clearly visible and as accessible as any other, so that the boxes are made with sloping sides becoming higher in the rear. Further, a place must be provided which will show, by means of index cards, what particular form or color is to be placed in each compartment. The whole apparatus should be portable and, therefore, fold into a relatively small space. Finally, it should be possible to determine afterwards whether the cards have been correctly assorted. For this purpose the cards fell into drawers divided into compartments to correspond with the boxes above; and to obviate the necessity of examining the cards at the end of each set, small sheets of heavy cardboard are inserted to separate the cards of one set from the others. Provisions for all these requirements have been made in the sorting apparatus here described. It has been thought proper to mention these points in order to indicate the reasons for the particular form which the apparatus has assumed.



The apparatus will thus be seen to consist of a set of compartments securely held in place and offering a convenient view of the index cards, indicating the particular form which each box is to receive. The boxes are made throughout of substan-

tial binder's board lined on both sides with black cloth. The eight boxes are built in two groups of four each, each group of four folding up flat and finding its place together with the drawers in one outer case, which also serves to hold the boxes securely when in position for use. There is abundant room in the case for all accessory apparatus, cards, etc., that may be required. It has been found convenient to adopt as a small set of cards a set of twenty-four, and for longer series one of forty cards. There have been prepared, as objects to be sorted, numbers; letters of the alphabet; simple geometrical forms, such as a square, circle, diamonds, etc.; pictures of familiar objects; small circles of colored paper to be pasted in the indented portions of the card and blank circles of paper on which words or any desired objects can be printed or drawn. While provision has been made for only eight compartments, it is possible to have special sets prepared with any desired number of compartments. If less than eight are to be used one need only omit the index cards in those which are not to be used or cover them over.

The actual experiment is carried out thus: the subject holding the pack of cards, say twenty-four, in his left hand, with the backs toward him and having in mind the nature of the task and position of the index cards, begins at a given signal to sort the cards as rapidly as possible. As he begins, the position of the second hand of an ordinary watch is noted, or a stop-watch may be started. The subject continues to distribute the cards one at a time, and as the last card is distributed the time of the whole process is noted and divided by twenty-four to give the time for the distinction and sorting of one card. It is interesting to know how much of the time is taken up in the mechanical process of handling and how much in the mental processes of distinction and choice. The handling time may be separately determined by having the subject go through the same operation again, but instead of placing each card in a determined place he places them anywhere, simply imitating in a general way the haphazard distribution of sorting. In so doing he has the backs of the cards toward him as usual, and turns them over so as to be able to recognize the printed form and color, but he need not actually stop to recognize them. In giving directions

it is best to ask the subject simply to go through the movement of turning the card over, but to keep his eyes fixed on the boxes and the movements of sorting. The time thus taken may be called the 'handling-time,' and if subtracted from the total time of the first experiment will yield approximately the time of distinction and choice. This handling-time is apt to be quite variable according to the effect of practice, and it is important to measure it at frequent intervals in the progress of the experiments. It should be understood that some care is required to determine this time in a constant way, and that the handling-time itself is of interest only as a rough index of motor facility, corresponding in form, not in significance, to what is known as a 'simple reaction-time.' It will probably be advisable in all tests to determine not only the complete time of a sorting experiment but the approximate time occupied in the mental processes of distinction and choice.

It may be well to describe some of the variations in experiment which the apparatus makes possible. Apart from the variety of sense-impressions, letters, colors, pictures, etc., one may test memory by having the sorting performed without the use of the index cards, the subject keeping in mind the compartment in which each variety of objects belongs. A curve of practice showing the acquisition of facility could be readily determined in this way. Again, one may retain the same number of distinctions and have a more limited number of choices by placing two or more different objects in the same compartment. Thus, one may either assort the colors, red, orange, yellow, green, blue, violet, into six compartments, giving each compartment one; or into three compartments, orange and red, yellow and green, blue and violet, respectively; or into two compartments, placing three colors in each. Another very interesting variation which increases the difficulty of the choice consists in changing the position of the index cards during the course of a single set. For this purpose a special device is necessary to procure an instantaneous change. It has been found impracticable to do this efficiently and retain the index cards in their usual position; but by displaying the index cards on the four sides of a block set up at the back of the apparatus, and exposing in turn each face of

the block, this type of experiment can be satisfactorily arranged, If one wishes purposely to determine the effect of the overlapping of mental processes, that is of doing two things, both distinguishing and sorting at the same time, he has only to perform the experiment with the cards held facing the subject. Other variations in experiment will be suggested by the requirements of different investigators.

The sorting apparatus, it is hoped, will find application in the accumulation of general tests of mental capacity and particularly in the study of the development of these processes in child growth. It seems well suited for the purpose by reason of the naturalness, the ease and the interest of the process of sorting. It may also be used as a substitute for more elaborate apparatus in laboratories and institutions in which the provision of an expensive equipment would be financially burdensome. And, perhaps, too, it may succeed in introducing, by reason of its general advantages, a much desired uniformity of method in the collection of measurements of mental capacity.[1]

[1] This apparatus will be supplied with various equipments by the Chicago Laboratory Supply Company, 31–45 W. Randolph Street, Chicago, to whom further inquiries may be addressed.

AN OPTICAL ILLUSION.

BY DR. CHAS. H. JUDD.
Wesleyan University.

In investigating the differences between monocular and binocular perceptions of the third dimension, an attempt was made to arrange conditions that should present the phenomena of both kinds of vision in the same field. The result was an illusion which throws light on the general problem. The illusion may be described as follows: Two threads are stretched through a box, parallel to the bottom of the box; the threads are at different depths, and cross each other at an acute angle. The observer looks obliquely down on these threads in the direction of their extension, so that the lines of vision form acute angles with the threads. If the threads are properly arranged and examined from the position described, the crossing can be seen by each of the eyes. Whether this last condition is fulfilled or not can be readily determined by closing the eyes alternately. If now the threads are observed binocularly it will be noticed first that the difference in depth is clearly perceived, and secondly that there is another thread—sometimes two can be seen—extending through the third dimension from the upper to the lower thread. This cross-thread is not easy to find in some cases, but if one of the crossing points is fixated it can be seen, and after it is once discovered it will be clearly perceptible.

We turn now to the explanation of the illusion. In examining the threads monocularly to find out whether each eye sees the crossing, it will be observed that the crossing points for the two eyes do not coincide. The interval between these points depends on the angle between the threads and the angle between the threads and the line of vision. Since these two crossing points do not coincide, they do not tend to fuse when both eyes are open. The result is that when the threads are observed binocularly the two crossing points remain as monocular points in the midst of the binocular field; and it can be shown that it is be-

cause of these monocular factors in the binocular field that the illusion described appears.

Another essential fact to be noted in the monocular observation of the threads is that the difference in the depths of the two threads is not perceived. Care must be taken to eliminate any association factors, such as differences in illumination, and it is well to cover up the ends of the threads so that the extension of the sides of the box between the two threads cannot be seen. If these association factors are removed the threads will seem to form a plain X in each case, and this X will seem parallel to the bottom of the box.

For purposes of analysis the binocular field must be divided into three sections, the monocular crossing points being the points which determine the limits of these sections. The first section is that which lies between the observer and the nearer crossing point. The third section lies beyond the more distant crossing point, and the second section lies between these two points. In all the figures these sections will be distinguished, section one being in each case the section at the left.

If the threads are examined binocularly with attention turned only to sections one and three, we shall have the usual binocular discrimination of depth and the usual phenomena of double images. Figure 1 represents this case. The lettering here

Fig. 1

adopted will be followed throughout the description, as will also the distinction in the lines. The full line, *ABCD*, represents the upper thread as seen by the right eye; the mixed line, *EFGH*, represents the upper thread as seen by the left eye; the broken line, *MNOP*, is the lower thread as seen by the right eye; and the dotted line, *QRST*, is the lower thread as

seen by the left eye. When the lines are drawn near each other and parallel it indicates the usual fusion of images seen binocularly.

Figure 2 represents the results of fixation with both eyes the upper thread at the more distant monocular crossing point. The images *ABCD* and *EFGH* continue to fuse, as do also the images *MN* and *QR*. *NO* does not fuse with

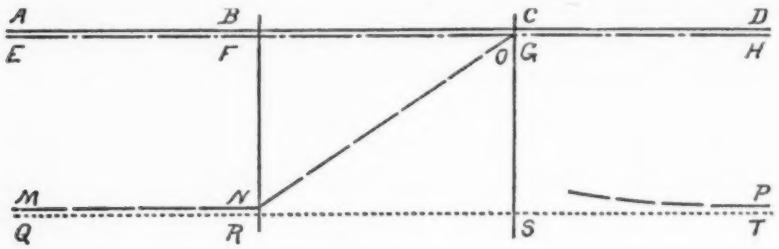


Fig. 2

RS. It is deflected so as to meet the upper lines at the more distant crossing point. Beyond this crossing point *OP* does not seem to fuse easily with *ST*. One of my observers sees clearly the line from *O* to *P*, but in general it is found to be vague, usually fusing fairly well with *ST*. The reason for this deflection of *NO* is not difficult to find if we recall the observations that at the monocular crossing points there is no perception of differences in depth, and that in this binocular field the crossing points continue to be points of monocular vision. Binocularly the parts of the threads lying in sections one and three are distinguished in depth. Monocularly, however, there must be two threads in the same plane crossing each other in the point marked by the three letters *O*, *C* and *G*. In order to

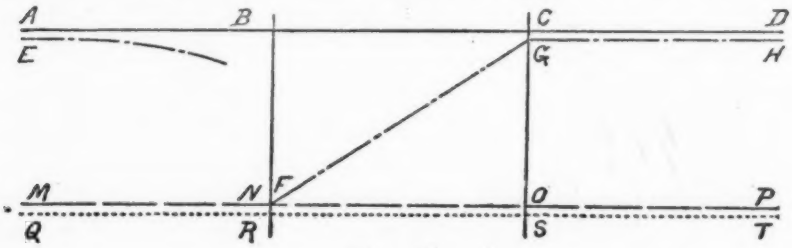


Fig. 3

satisfy the binocular and monocular demands, the double image *NO* is deflected so as to pass from the lower to the higher plane.

Figure 3 represents the result of fixating the lower thread at the nearer monocular crossing point. In this case *MNOP* and *QRST* fuse into a single image. *CD* and *GH* also fuse, and stand out in the third dimension nearer than *MP*. *GF* is deflected for reasons similar to those on account of which *NO* was deflected in the case described above.

Figure 4 represents a union of the conditions described in the last two cases. The interesting fact which is here illustrated is the fusion of two images which do not belong together, for while *NO* is a part of one of the double images of the

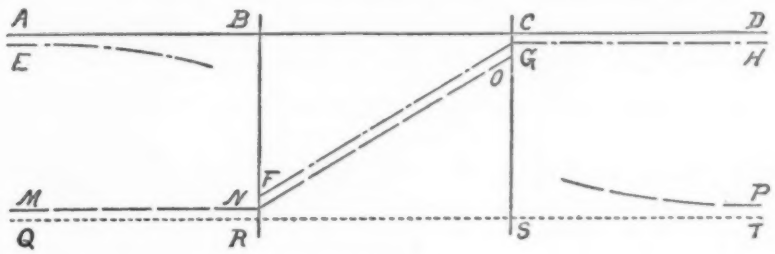


Fig. 4

lower thread, *GF* is a part of one of the double images of the upper thread. Nevertheless, since both of them are deflected into the third dimension and travel in exactly the same path, they fuse completely and appear like a third thread, cutting across from one of the original threads to the other. This third thread is so clear that its path can be traced with a pencil. That it is such a combination of images from the upper and lower threads can be shown by using different colored threads in the two cases. If we use red and blue threads, for example, the resulting third thread shows the fluctuations in color regularly observed in stereoscopic combinations of images of unlike color.

The detailed descriptions given of these deflections of *NO* and *GF* will serve to explain the deflections which are seen when *BC* and *RS* form the crossing line.

Figure 5 illustrates the most complete form of the illusion. If the eyes are fixated at a point in section two, about half way

between the two original threads we get the deflection of all four images between the monocular crossing points. *BC* and *RS* unite to form one cross-thread, *GF* and *NO* to form the other. In sections one and three the lines fuse completely enough to give a clear discrimination of their different depths.

The illusion brings out clearly some important facts in regard to monocular as distinguished from binocular vision. The

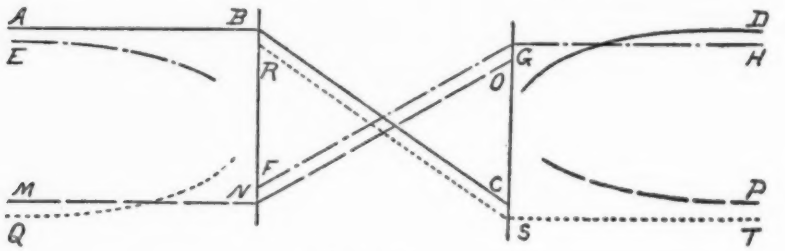


Fig. 5

first fact is the lack of discrimination of depth already noted, the second is the prominence of binocular factors in determining the planes in which the monocular images seem to be situated.

It may be well to present further evidence on both of these points. We may stretch a series of white threads side by side and parallel to each other in front of a black background, and at different depths. (I find that in all these experiments the results are all very much more satisfactory when white threads are used rather than the black so often employed; the images have a much sharper definition.) If such a system of threads is observed monocularly, the ends being covered by a screen, and the illumination being regulated so as to eliminate all shadows, it will be found impossible to determine the relative depths of the different threads. Very often the observer will think that he recognizes the depth of a thread, but in such cases his answer is often the exact reverse of reality, and in general the judgments are very uncertain. The whole series of threads seems to be in about the same plane. If the observer opens the closed eye and looks binocularly at the threads, the change is very marked. The threads stand out clearly in their respective

positions, with no indefiniteness whatever. It may be objected that such evidence does not go to show that monocular vision does not give us depth, it only shows that relative depth is very inadequately presented; while the fact still remains that the whole system was recognized as distant from the observer and this recognition is in itself the perception of depth. I confess that the objection is not easily laid aside. But it should be remembered that projection to a position outside of ourselves is a factor that has become so firmly associated with all visual perceptions that it can never be eliminated by experiment. Furthermore, there is much evidence which tends to show that this projection is due to sensations derived from movements, particularly movements of convergence, and from binocular factors. If evidence is produced which shows that relative positions in depth are not perceived in monocular vision, then it seems not altogether improbable that the perception of absolute depth is itself subject to the same general laws. It should be clearly recognized that the evidence here presented does not point merely to imperfect measurement of relative depth, but rather to an entire lack of such perception in monocular vision, and to a qualitative difference between such vision and vision with two eyes.

Another variation of this experiment is to turn the system of parallel threads so that they will be exactly horizontal with respect to the axes of vision. The images on the two retinas will then furnish none of the differences commonly designated as difference in binocular parallax. The images will be merely continuations of each other. The system of threads viewed binocularly in this way will appear, just as it did in pure monocular vision, devoid of depth distinction. The reason is evidently the removal, under the conditions described, of all the factors which characterize binocular as distinct from monocular vision.

An interesting natural production, of the same general conditions as those described in the last experiment but one, is to be found in the bare branches of a tree when they are seen against the bright background of the sky. The sizes of the branches are, of course, unknown, and one associated factor is thus elim-

inated. If an observer confines his view to the ends of the branches so as to eliminate as far as possible the indirect data that come from their crossing he will have fairly good conditions for observing the facts described. Viewed monocularly it is almost impossible to distinguish the branches as different in their distances, but when viewed binocularly the whole comes out in very strong relief.

Another series of facts which can be explained on the principles pointed out, and which have as yet received no adequate explanation on any other, are the facts of change in the apparent size of objects due to a change in the degree of accommodation. If we close one eye and hold an object, as the finger, in the line of vision of the open eye, and then gradually bring the finger nearer and nearer, following it in its approach with increasing accommodation, it will be observed that any object lying in the line of vision beyond the finger will seem to grow smaller and smaller with the increasing accommodation. In explanation of this phenomenon, Hering[1] has pointed out that the finger, seen in clear vision, gives an image which is gradually increasing in size as the finger approaches. In spite of this increase in the size of the image, the apparent size of the approaching finger is judged to be constant. The result is that other objects whose images remain constant in size appear by comparison with the expanded image of the finger to be growing smaller. That this explanation is not adequate is shown by the fact that an observer who can voluntarily increase the degree of accommodation without the aid of the approaching finger finds that such an increase results in exactly the same apparent decrease in the size of objects seen in indirect vision, though in this case there is, of course, no comparison of any kind. Stumpf's[2] explanation is as follows: The physical state of accommodation produces the sensation of distance, and when the retinal image remains constant in size, the size of the object must be regarded as different if the degree of accommodation is different. In the case described, the degree of accommodation is changed; the result is a judgment of difference in the size of the object. The evident

[1] Beiträge zur Physiologie, p. 14.
[2] Über d. psych. Ursp. d. Raumvorst, p. 205.

assumption made in this explanation is that a single standard of judgment holds for all objects in the monocular field. But this single standard cannot apply unless there is a failure to recognize the difference in the depths of different objects. The assumption is in its consequences, then, in agreement with the position already taken, namely, the position which denies the possibility of the direct perception of depth from the data given in monocular vision. Professor James describes the corresponding binocular phenomena as follows: "If the reader will hold his forefingers, one beyond the other, in the median line, and fixate them alternately, he will see the one not looked at, double; and he will also notice that it appears nearer to the plane of the one looked at, whichever the latter may be, than it really is." The explanation offered is: "Its changes of apparent size, as the convergence of the eyes alter, also prove the change of apparent distance. The distance at which the axes converge seems, in fact, to exert a sort of attraction upon objects situated elsewhere. Being the distance of which we are most acutely sensible, it invades, so to speak, the whole field of our perception."[1] But Professor James seems to have overlooked the fact that this attraction of objects towards the point of convergence does not appear when we are looking at solid objects which give corresponding images in the two eyes. It appears only when the objects give double images, that is, when they are not fused. When they are fused, as in the case of stereoscopic figures, there is a very decided extension away from the center of convergence, and, as remarked, in the case of the images from real objects, there is certainly no such attraction towards a single point. The explanation offered holds only when the images are not fused, that is, when the effect is really monocular. And we may assert it as a general principle that in monocular vision objects tend toward a single plane, the plane determined by binocular factors. If associated factors are removed, they actually reach a single plane. In binocular vision, on the other hand, they are distinguished as lying at different depths.

The bearing of such facts as these on any general theory of space perception is not far to seek. They cannot in any way

[1] Principles, Vol. II., p. 230.

be made consistent with a theory that holds that there is an original three-dimensional extensity in all sensation—monocular as well as binocular. Our perception of depth must rather be regarded as in some way the result of the combination of binocular retinal factors and factors of muscle-sensation.

CULTIVATED MOTOR AUTOMATISM; A STUDY OF CHARACTER IN ITS RELATION TO ATTENTION.[1]

BY GERTRUDE STEIN.

In the PSYCHOLOGICAL REVIEW for September, 1896, Mr. Solomons and I reported on the work done that year on the tendency to motor automatism in normal subjects. The only subjects we had were ourselves. This year it has been my aim to continue this work by using a large number of subjects.

I have attempted to examine the phenomena of normal automatism by a study of normal individuals, both in regard to the variations in this capacity found in a large number of subjects, and also in regard to the types of character that accompany a greater or less tendency to automatic action. Incidental to this main question have arisen the further questions of comparison between male and female subjects, and the variations of the female subjects in fatigue.

For these experiments the most convenient instrument I found to be a planchette suggested by Mr. Delabarre. We suspended from a high ceiling a board just large enough to support the forearm, the hand hanging over and holding a pencil.

This planchette responded to very slight movements, could be readily adjusted, and allowed the operator to move it, and guide the subject without his knowledge. By lightly resting my hand on the board after starting a movement I could deceive the subject, who sat with closed eyes, as to whether he or I was making the movement, and I could judge also how readily he yielded to a newly suggested movement, or if he resisted it strongly.

My method was as follows: My subject, after adjusting his arm and getting perfectly comfortable, would close his eyes and I would then direct him to keep his mind off the experiment and off his arm. Sometimes I would talk to him, sometimes get

[1] From the Harvard Psychological Laboratory. Communicated by Professor E. B. Delabarre.

him to talk to me, or to think of a definite object, or to lose himself in a day-dream.

The movements taught, with the exception of one or two of my best subjects, had to be of a decidedly rhythmic character, such as circles, the figure eight, a long curve, or an m-figure. The majority of the subjects were either readily taught some rhythmic movement or had some spontaneous movement of their own; either a rhythmical one or indefinite lines and curves. With some few subjects it took several sittings before any movement could be induced.

The method of teaching a new movement was as follows: When the subject's attention was fully distracted I would gently, at first slowly, then more rapidly, guide the planchette into the movement I wished to teach; then after a while I would release the board. The subject the first few times would either come to a standstill or return to the old movement. I would guide again, and then release, keeping this up till the new movement was learned. At first there was a continued return to the old movement or to no movement, but gradually came an aimless indefinite movement, then again the old, then the new, and then again an uncertain movement, then a more decided revision of the new, then a slight return to the old, like the struggle between two themes in a musical composition, until at last the new movement conquered and was freely continued.

In many cases it was hard to get the subject started. Often I succeeded in doing so by giving deceptive suggestions as to my guidance by letting my hand rest lightly on the edge of the board. Sometimes I would let the board hit my hand to give the same effect, or suggest the movement by following the curve with a pencil on another piece of paper, or let my sleeve brush the table to suggest my movement and so get the desired response from the subject.

The subjects used in this experiment were members of Harvard University and Radcliffe College. The large majority were taught some form of automatic movement. Out of 41 male subjects I found only 5 from whom in two sittings I was not able to get any kind of automatic response, and out of 50 female subjects only 4. There was a great deal of variation in

the ability to learn movements and write spontaneously. The subjects who did the best writing fall into two large groups very different both in characteristics and method of response. Let us call them Type I. and Type II.

Type I. This consists mostly of girls who are found naturally in literature courses and men who are going in for law. The type is nervous, high-strung, very imaginative, has the capacity to be easily roused and intensely interested. Their attention is strongly and easily held by something that interests them, even to the extent quite commonly expressed of being oblivious to everything else. But, on the other hand, they find it hard to concentrate on anything that does not catch the attention and hold the interest. The nature and fashion of their automatic responses accord with these characteristics. I could never get them to write well unless I got them distracted by talking to them or making them talk to me. The more interested and excited they got the more their hands would write. Their results in writing were of two kinds: either they would be taught a movement and then hold it *firmly* until the next one was taught, or else, being taught one movement, they would stick to that resolutely, and it was not possible to draw them away from it. As soon as they stopped talking, or their interest flagged, there was a strong tendency for the movement to slow up and soon stop. This type, although in some cases suggestible, is on the whole auto-suggestible rather than responsive to influences from without, unless the appeal is directed completely to the automatic personality. The subjects usually expressed themselves at first as having an impersonal feeling toward their arm and then becoming oblivious of it. Their arm started, kept going when they were forgetful of it, and when they thought of it, it stopped.

Type II. is very different from Type I., is more varied, and gives more interesting results. In general, the individuals, often blonde and pale, are distinctly phlegmatic. If emotional, decidedly of a weakish sentimental order. They may be either large, healthy, rather heavy and lacking in vigor, or they may be what we call anæmic and phlegmatic. Their power of concentrated attention is very small. They describe themselves as

never being held by their work; they say that their minds wander easily; that they work on after they are tired and just keep pegging away. They are very apt to have premonitory conversations, they anticipate the words of their friends, they imagine whole conversations that afterward come true. The feeling of having been there before is very common with them; that is, they feel under given circumstances that they have had that identical experience before in all its details. They are often fatalistic in their ideas. They indulge in day-dreams, but not those of a very stirring nature. As a rule they don't seem to have *bad* tempers—are rather sullen. Many of them are hopelessly self-conscious and rather morbid.

They write best as a class when they are quiet. The effort to explain something usually stops the hand. They get rather sleepy, the arm and hand get cold and occasionally go to sleep. As a rule they are highly suggestible and learn movements readily, but instead of getting a new movement and sticking to it, they often show great vacillation, a constant tendency to return to other movements taught some time before. And even when a new movement gets fixed, there is a constant tendency to outcroppings of an old movement in most unexpected places.

It will readily be seen that this last type is much nearer the common one described in books on hysteria. The automatic personality here comes much nearer being the real personality constantly, in the ordinary affairs of life, the automatic personality obtrudes itself, giving a sense of doubleness, of otherness, to which the feeling of having been there before, of premonitory conversations, and all the phenomena that go with this type of character are to be referred. This was well illustrated by one of my subjects who every now and then would ask me if he might try and stop his hand. I said yes. He would stop, and then he would say that he wanted to stop because he did not know whether he could do so or not and he wanted to be sure. He repeated this at intervals all through the experiment, and never seemed quite sure that his arm was not going of its own accord to such an extent that it could not be stopped. This subject was a very typical case of Type II. In one form or another this was frequently mentioned by subjects

of this type. The sense of otherness, of something else pulling or setting the arm going, was a very common experience.

In these descriptions it will be readily observed that habits of attention are reflexes of the complete character of the individual, and again on habits of attention are dependent the different forms and degrees of automatic writing.

In this statement of the two types I have given a composite picture. In both cases the variations are many and the cases where the characteristics are found in any kind of completeness comparatively rare, and there is an intermediate place where the characteristics lap over. I will now give a few typical cases of each group.

But first a word as to an interesting fact shown in this study. A large number of my subjects were New Englanders, and the habit of self-repression, the intense self-consciousness, the morbid fear of 'letting one's self go,' that is so prominent an element in the New England character, was a constant stumbling-block. It usually took a New Englander a sitting longer to give a response than the other subjects. I could usually tell them as soon as I began the experiment by their resistance to my guidance. Afterwards I found that Stanley Hall, in his article on Fears, notes the fact that self-consciousness was dreaded by twenty-four boys in Cambridge, Mass., a thing unknown in Trenton or St. Paul.

TYPE I., CASE I. A female subject with no tendency to somnambulism or automatic sleep habits. She was not absent-minded and had no morbid fears. She was of an irritable, nervous nature and not suggestible.

RESPONSE. At the first sitting I got very little response, only a very slight tendency to movement. She said her arm was slightly numb. The movement increased toward the end. At the next sitting she gave very good movement. She got excited thinking and the result was a decided movement. I guided the pencil a number of times, but with few exceptions she was wholly unconscious of it. She did not follow suggestions much, but stuck to her own movement, which was very much like real writing.

CASE II. A male subject. Not particularly dreamy, has

automatic sleep habits to a slight degree, answers questions in sleep. He concentrates his attention readily, is impetuous and apt to be carried away by things.

RESPONSE. He writes very readily and learns the movements easily, but any pause in his talk or mine always stopped him. When thoroughly interested in something he wrote well, and passed from one movement to another readily in answer to my suggestions.

CASE III. Male subject. When interested his attention does not wander; if not interested he becomes dreamy. He frequently takes automatic notes in lectures. He has a vivid visual imagination.

RESPONSE. Learned a new movement easily to a certain extent, that is he could be taught, but drifted back to his own spontaneous movement. When thoroughly interested in talking he learnt a new movement and retained it. He would keep it up even after he stopped talking, his movement would grow more vehement, then would slow down and the newly taught movement would be forgotten and he would return to his old one. He learnt best when his attention was strongly attracted, he was then unconscious of his hand and wrote rapidly.

CASE IV. Female subject. Decidedly objective in character. An excellent English student and has a vivid imagination, very little power of self-analysis, and does not care for abstract thought. The mystic side of art does not appeal to her.

RESPONSE. At the first could get no response. Second sitting she learned one movement readily, but learned it to the exclusion of everything else. When interested talking she wrote readily. At the next sitting she learned a movement readily and gave it with greater and greater rapidity. The movement became hurried and incessant and it was impossible to guide it at all. Even when the board was held still her hand kept up this movement. She then went from one movement to the other, giving them all with great rapidity.

The tendency here noted to movement much more rapid and incessant than is executed under normal conditions is a very marked characteristic of automatic writing. I have found a number of instances of it which reminded me of the rapid and in-

cessant movement seen in revival meetings, where people under the domination of religious frenzy swing their arms and beat their breasts in rhythmic time. I will cite an example of this type of movement in one of my subjects. He had a spontaneous movement of a circle made with the swing of the whole arm. He began these circles, gradually increasing in speed, not breaking into any other movement; just a continued rush of circles. Gradually the circles elongated to forward and back and the movement slowed down. It took him three minutes to reach his highest speed, at which rate he kept on for five minutes, and then settled down to a uniform speed which he kept up as long as the sitting lasted. The whole movement was purely spontaneous. He described the movement as if it were started not only by him, but by his forearm and hand.

TYPE II., CASE I. Female subject. No automatic sleep habit, good natured, phlegmatic. She has premonitory conversations that come true. Falls readily under personal influences, not a determined character nor imaginative. Strongly dominated by impressions of childhood and superstitions. She does not concentrate her attention easily, and finds it very fatiguing when she does. When tired she relaxes by giggling. She says she keeps on working long after she has ceased to work vigorously.

RESPONSE. Her arm felt impersonal very quickly, even at the first sitting. She was readily taught a movement, although she did not adhere to it strongly. She was conscious of the movement, but did not feel as if she could stop it. Her hand became cold and stiff. At the second sitting there was a slight tendency to return to the movement first taught, but it did not continue long and had to be retaught. After four sittings the first movement was readily remembered. At one sitting the subject's mind seemed more active and wide awake than usual and the response was poor; finally she became quiet and sleepy and then the movement was readily adopted and adhered to.

CASE II. Male subject. Pale and physically rather weak. Feared the dark very much as a child. Concentrates his attention fairly well when interested. Not imaginative.

RESPONSE. He stopped writing when he began to talk or

think out something. His hand yielded quite readily to suggestion, but the movement was never carried on long. He wrote best when silent and a little dreamy.

CASE III. Male, pale type. No automatic sleep habits, rather nervous and absent-minded. He has a tendency to forget his ideas just as he is expressing them. He has a worrying nature, gets very much interested in his work. He has difficulty in formulating his ideas and has to work them out with an effort, and is always uncertain as to exactly what is wanted of him. He is very conscientious and has had a nervous breakdown. During his writing he frequently got a nervous shiver.

RESPONSE. He wrote vigorously in rather a nervous fashion and was never conscious of any change in his movements. He commented upon his being uncertain as to whether he could stop his hand. He spoke of an indescribable impulse to go on, the effect of an outside dragging. He had a good deal of spontaneous movement that went on constantly and rapidly. When he thought hard of a word it had no effect on his movement except to increase its rapidity.

CASE IV. Male subject, not particularly imaginative and no morbid fears. Thinks he is introspective, but is not quite sure. Is very self-conscious, and gets easily worn out. Pale and weak physically, morbidly sensitive and uncertain of himself. Small power of concentration.

RESPONSE. He said his arm seemed to be going as if he could hardly help it, but it was very hard for him to keep his mind off of it. He felt as if the arm were going by itself even when he thought of it, but he thought he could stop it if he wanted to. After some training he went readily from one movement to the other. He spontaneously made indeterminate curves and lines. He did not think I was moving his arm, but he did not think that he was doing it either. He never stuck to any one movement any length of time. When he thought of a word at first there was no tendency to write it, but the curves gradually became more and more determinate till finally the word was written. He felt that he had gotten very near it, but he never knew whether he had really written it. He wished that he could stop thinking of his hand, but was unable to.

Afterwards he thought possibly that he had written the word cat, but he was sure that he had not written rat, to which he had changed in thought. In reality the word rat had been clearly written.

The few cases where no response was obtained show no particularly interesting characteristics. The subjects are usually indifferent, without the accompanying characteristics of Type II. They were not morbid and usually had fairly good power of concentration, without much imagination.

To study the effect of fatigue, I took the Radcliffe students just in the midst of the examinations. I was, therefore, not able to examine a very large number of students.

I found Type I., as a rule, showed a tendency to become highly irritable, more auto-suggestible than before, and that the tendency to rapid and spontaneous movement increased. Type II., on the contrary, got worn out, lost all spontaneity, became if possible more suggestible, and showed a tendency to nervous jerks and great inequality, also extreme fatigue and depression.

TYPE I., CASE I. In the normal state the subject had given considerable response and had been fairly suggestible. In the fatigued condition there was a good deal of movement with increasing rapidity. The subject is irritable, and feels a distinct shock when her pencil slips from the paper. The subject was wholly unconscious of her movements, but did not respond to guidance as readily as before. She began to write things resembling words, her face tense. The hand was tense and the breathing heavy. The movement is very strained, and the hand jerked a good deal. She described herself as being all upset by the examination.

CASE II. Had in normal condition learned to give a few movements very vigorously when distracted by talking.

Fatigued, she fell readily and spontaneously into movements. The examination had interested and aroused her. This was shown in the rapidity and spontaneity of her movement and her inability to yield to suggestion. The movement increased and became more and more violent.

She said it seemed to her to be wholly in the forearm and that for the most part she had forgotten all about it.

INTERMEDIATE TYPE. In normal condition there was considerable suggestibility, but also a certain amount of spontaneity and vigor in response.

FATIGUE. Gave an easy spontaneous movement at first. Was very lethargic and complained of backache. Followed guidance readily, but without energy. Finally I got her to respond better by rousing her and getting her to talk.

TYPE II., CASE I. Normal, rather a negative case with a leaning toward Type I.

FATIGUE. Tired in back of neck, not excited. There was some spontaneous movement, but much less response than was ever gotten before. Lethargy had markedly increased.

CASE II. In normal condition not very good in response and only fairly suggestible.

FATIGUE. Tired out. Very little spontaneous movement, sluggish response with many stops. Hand jerks a good deal and whole movement is very uneven. Finds writing makes her back ache. After the strain of examinations are over she feels tired a long time and often gets more tired and then gives out.

There were also a couple of cases where there had been no response before, and the subject had comparatively little fear of the examinations and did not worry. There was no noticeable change in the reactions.

The difference in response between the male and female subjects was not very pronounced. The types in the girls were perhaps a little more determinate in the case of Type I. In the case of Type II. this was not so, nor in the indifferent cases. There was also very little difference apparent in nervous condition as between the sexes. I did not have the men during the examination period, so I was unable to judge of the relative effects of fatigue.

In the subjects that I had think steadily of a word I was surprised to find that the motor reaction was very slow and in some cases did not come at all. The move was made more rapidly or more slowly, but that was all. Several times the subjects wrote the word after some time. The subjects also were unable to judge of their performance. One case repeated meaningless

curves over and over again, convinced that he was writing a word, and another when fatigued started in on certain curves and repeated them again and again, finally convinced that they meant something, although she could give no explanation of them.

In one case, where the subject had been at one time left-handed but where now the right hand was habitually used, the left was more responsive automatically.

In conclusion I wish to recall to the reader a paragraph in the article printed in the PSYCHOLOGICAL REVIEW (page 502) for September, 1896, by Mr. Solomons and myself. We there state the fact that in order to become automatic "our training was purely a training of the attention. Our trouble never came from a *failure* of reaction, but from a *functioning* of the attention. It was our inability to take our minds off the experiment that interfered. From that start whenever by good luck this did happen, the reaction went on automatically. The hysterique has no trouble here, for he is unable to attend to the sensation, attention to which bothered us. It is his anæsthesia which makes automatism possible. What in his case is done for him by his disease we had to do by acquiring a control over our attention."

Now, in the two types as I have described them this is exemplified. In Type I. we have subjects who had to have their attention distracted in order to have the experiment succeed. In Type II. we have the cases of subjects very much nearer the true hysterique, where powers of attention, or rather lack of power of attention, induced an extreme suggestibility and a great tendency to automatic movement. In the cases of fatigue we find this consistently carried out. In Type I. fatigue took the form of nervous excitement, which meant a greater distraction and therefore better automatism. In Type II. we find exhaustion, less power of concentration, and resultantly increased suggestibility, but less vigor in response.

We also find, both in the normal condition and in fatigue, a distinct relation between these two types and the physical condition and blood supply. In Type I. circulation seems good, and the nerve centers are freely stimulated, attention is active, and

the subject rarely complains of the hand being numbed in going to sleep. After an examination this type is roused, the nervous system is still more highly stimulated, and the attention even more easily concentrated, and, therefore, distracted. Unfortunately, I did not have a chance to examine these subjects after the stimulation had lost its effect, since they usually came to me immediately after the examination.

In Type II. we have just the reverse. Sluggishness is a pronounced characteristic, whether the subject is healthy or delicate. The nervous system lacks stimulation, the hand gets numbed and falls asleep, which seems to indicate a sluggish circulation, the subject gets drowsy and is docile. In fatigue these symptoms are all exaggerated. Examinations do not stimulate but rather exhaust. Backaches are common, lethargy increases, repose becomes feeble, the subject is, in short, worn out, and the nervous system is incapable of stimulation. The attention is even more diffused and less capable of concentration than before.

DISCUSSION AND REPORTS.

THE PSYCHOLOGY OF INVENTION.[1]

In addition to the various points of view regarding the psychological status of originality which the President's address and the careful analysis and significant tests of Professor Royce have ably presented, certain other aspects of the fundamental problem may be reached by approaching it from still different directions. There is first the anthropological aspect, which would consider originality as a combined racial and social characteristic—the result, as is the case with so many mental capacities, of both nature and nurture. In this way the problem very naturally becomes a portion of the general problem of variation—the distribution of mental powers among men. One of the first attempts to present the laws of distribution of human faculty—that by Mr. Galton in his 'Hereditary Genius'—still remains one of the best. It indicates, however unsatisfactorily, the law-abiding character of mental endowment, and substitutes a well-conceived and measurably definite conception of mental superiority for the much vaguer notions of popular discussion. It enables us, also, to frame our questions with greater precision and significance, even when it does not yield the material for answering them. Applying the conception of distribution according to the degree of differentiation from the average, above and below, to the races, we should expect that races of an inferior degree of average intelligence would present a less varied degree of differentiation than that presented by a race of superior intelligence, that the individuals of such a race would be much more like one another than the individuals of a more developed race, and that persons of special and unusual endowment would be less common among the former than among the latter. Comparisons of the white and negro races, of civilized and savage, are at once suggested, and the evidence seems in favor of the deduction presented above. None the less, differences of life and training are so prominent in these comparisons that adequate and comparable standards of estimation are not easy to find. Yet, as man in a measure fashions his own environment, that environment itself becomes a significant index of his variability.

[1] Discussion before the American Psychological Association, Ithaca, 1897.

Extreme conventionality, rigid habits of thought and unchangeable customs of life would be at once a result of and a means of propagating a lack of variability. An appropriate biological test is the relative extent of the pre-adult or especially adaptable period of life in different races. The cumulative evidence there is quite forcible, and indicates an earlier maturity, both physiologically and psychologically, among the lower races, and this materially lessens the probabilities of divergence from stereotyped standards. It would thus appear that the possibility of being different from one's fellow men, and in such differences of pointing the way to higher and better things, is itself an important anthropological factor in developmental movements. This, in a measure, presents the phylogenetic aspect of originality corresponding to the ontogenetic problem, which aims to discover under what conditions the individual varies most from his average self, particularly in the direction of useful as well as unusual thinking. And the two aspects, owing to the interaction of nature and nurture, are constantly coördinated, and may, therefore, be studied together with advantage to each.

The unusual and the extreme exercise a psychological fascination which does not belong to the contemplation of the commonplace but significant average. The explanation of a man of genius is the attractive problem which the ambitious student, whether of literary or scientific temperament, finds it difficult to resist. The explanation in more than a general way of individual occurrences, when these occurrences are in themselves complex, is possible only in advanced stages of science; and the science of human character which John Stuart Mill and others hoped to establish is as yet unable to solve much simpler problems than this. Genius represents not only an unusual, but a desirable, variation in mental products. Mere eccentricity is frequently excessively unconventional and bizarre; the thought processes of delirium or insanity often present a maximum of originality. Divergence from the average is thus a common property of genius and insanity. Are they alike in other respects, and does their likeness indicate an underlying community of nature, or is it mainly superficial? This vexed problem thus becomes closely related to that of selective thinking and mental variability. The upholders of the essential similarity of genius and insanity point to the many cases in which symptoms characteristic of abnormal states appear at times among great men; they point to hereditary influences and the frequent tainting by mental diseases of the great man's family. The considerations to which the present discussion would attach impor-

tance would be of a different type. Are the mental processes and products of genius similar to the mental processes and products of the insane? Are the periods and the moments of high original activity subject to the same influences in the two cases? It seems likely that a careful inquiry along these lines will contribute something to the better comprehension of the general problem.

While it is convenient and appropriate to certain discussions to consider mental superiority as a general attribute, it must be borne in mind that it most usually appears as a great capacity in one direction; the distribution of the several mental powers within the individual must be considered, as well as the rank or excellence of the aggregate of such powers. Musical genius furnishes good instances of such one-sided endowment, of an overwhelming passion for one form of pursuit. But here, as well as elsewhere, it is pertinent to investigate the more immediate causes and occasions which incited such a great passion to its most successful and most original expressions.

It seems hardly necessary to add that these suggestions are not offered as aids to the solution of the nature and conditions of appearance of original mental states, but merely as memoranda for the general marking out of the field in a preliminary survey.

JOSEPH JASTROW.

THE EXTENDED PURKINJE PHENOMENON (FOR GRAY LIGHTS).

By the Purkinje phenomenon is usually meant the curious fact that blues and especially greens look abnormally bright when the illumination is diminished, and that yellows and especially reds look abnormally dull. The name commends itself as being also a proper designation for the still more curious fact that when the reds and (blue) greens are combined so as to give a colorless mixture, and also the blues and the yellows, these mixtures, if made equally bright for an ordinary illumination, differ very much from each other, and also from an undecomposed colorless light, when the illumination is faint, and that in spite of the fact that, as far as the undiscriminating human eye can make out, they are all three identically the same thing. Tschermak, in a recent paper,[1] does not make use of this term, but it is evidently the right name for the fact, and its use will facilitate the report of Tschermak's observations. It is the Purkinje phenomenon only

[1] Ueber die Bedeutung der Lichtstärke und des Zustandes des Sehorgans für farblose optische Gleichungen. Armin Tschermak, Pflüg. Archiv, 70, 297–329.

in so far as it deals with these colorless mixtures that is the subject of the present paper. The fact itself is evidently in direct contradiction with Newton's law of color mixtures. That law states that if there are two pairs of indistinguishable light-mixtures, the double mixtures formed by uniting them two and two will also be indistinguishable; as a particular case, one particular pair of light-mixtures may be the same as the other pair, and hence the law covers as well the supposed *constant equivalence* of two light-mixtures (and in particular of two colorless light-mixtures) under all variations of objective intensity of illumination. The difficulty which besets the search for truth by experimental means, even in well-appointed laboratories, is well illustrated in the historical sketch with which Tschermak begins his paper. Newton's law was tested experimentally, and proved to be valid, by Maxwell and by Aubert by means of the color-wheel. As Hering pointed out, this is very inadequate *proof*, so far as colorless mixtures are concerned, because grays made out of different colored papers are very likely to be, in the end, physically exactly alike. [This objection does not hold for a *disproof* of the law; for it is evident, even in the absence of a spectroscopic examination, that a *difference* in sensation-effect could only be due to a difference in light-ray composition.] v. Kries and Brauneck (1885) tested the law by spectral lights (colorless equations being included) and declared it to be valid. At the same time Hering published the results of his own investigation of the question, both by papers and by a good color-mixing apparatus, and declared the 'complete constancy' of colorless equations under changing illumination.

The next year, in his paper *Ueber Newton's Gesetz der Farbenmischung*, he reaffirmed this result in the strongest terms, and declared that any exception to Newton's law (whether due to different intensities of the lights or to changed conditions of the retina) would be quite inconsistent with our knowledge of the structure of the universe, and was *überhaupt* wholly unthinkable. If changes should afterwards present themselves at higher intensities than he had been able to try (he does not mention any exceptions for low intensities, which were of course easily attainable), it would be easier to suppose that secondary changes had been caused in the tissues of the eye by the strong light than to give up the validity of Newton's law. Hering also maintained with equal conviction, as the result of his experiments, that the equations were not affected by the local condition of the retina, by fatigue, by increase or diminution of excitability, by simultaneous or successive contrast, or in fact by anything whatever

that could affect the temporary excitability of the eye. And v. Kries, in two papers in Du Bois' Archiv in 1878 and 1882, had also announced that equations of all kinds persisted, no matter what the condition of the eye. The first authors who affirmed the dependence of colorless equations upon the intensity of the light for the trichromatic eye were Chr. Ladd-Franklin and Ebbinghaus.[1] Hering, in his paper of the same year, attributed the reported departures from Newton's law, both for colors and for grays, to certain sources of error, and in particular to the varying proportional absorbtion of the yellow pigment of the retina for varying intensities, and he reaffirmed most explicitly the independence of color-equations, whether seen centrally or peripherally, of, first, the intensity of the light, and, second, the condition of the retina. It is at this point that Tschermak quite destroys the dramatic character of his tale by leaving out the part played in it by Hamlet. It was König who definitely effected the connection between the changed relative brightness of the different portions

[1] My own experiment was made for the express purpose of testing the Hering theory—that is, for deciding the question whether two opposite colors were antagonistic or complementary. If the color-processes had destroyed each other, in a colorless mixture, and left behind only the accompanying white-process, then that ought not to be changed on the two sides of the equation (on the two zones of the color-wheel), being a chemical process of exactly the same nature in both. But if the two pairs of color-processes contributed as such (either in whole or in part) to the colorless result, then, since they were brought about by different light-ray combinations, there was no reason to suppose that they would be equally affected by every possible change of circumstance; and, in fact, König's recent measurements of the Purkinje phenomenon for colors made it probable that they would be unequally affected by changes of intensity. That turned out to be the case. The argument was conclusive against the Hering theory, until after König's discovery that the renewal of the powers of the eye in a dull light is due to the renewal of the rod-pigment. If the eye adds to itself an entirely new function in a faint light—a new organ, so to speak—a new absorption medium and that not of an 'orthochromatic' kind, then, of course, any irregularity of sensation is accounted for; and in this case the irregularity becomes immediately a regularity, for the light absorbed by the visual purple is of exactly the light-ray composition to account for the spectral constitution of the new sensation. All this has been so self-evident, in the light of recent discussion of rod-function and rod-pigment, as not to stand in need of explicit statement.

Professor Ebbinghaus has never explained how it happened that he published his 'discovery' of the extension of the Purkinje phenomenon to colorless light without any reference to my previous announcement of the same fact. He could not easily have been unaware of it, for his experiments were carried out in the same laboratory as mine—Professor König's—and he listened to my paper read before the Psychological Congress at London (1892), of which a printed abstract was also distributed.

of the spectrum and the changed condition of the retina, by showing the quantitative coincidence between the former and the visual purple absorbtion. Hering had been, it is true, for some time insisting upon the importance of attending to the state of adaptation of the eye in all experiments with light, and he made a particular study of the Purkinje phenomenon, in the limited sense of the term; but the *experimentum crucis*, by which it was connected with the visual purple, and hence with the rods, and hence with the white-producing portion of the visual apparatus (and by which, therefore, the fact was robbed of its force as an argument against any theory of antagonistic colors), was carried out by Professor König. Tschermak has taken up his present investigation at the instance of Professor Hering, and has carried it out in his laboratory. His purpose was to show that the departures from Newton's law are not due to anything in the nature of the *change of intensity* in itself, but that they are due to a change in the adaptation condition of the retina, which is in turn caused by the change in intensity of the illumination—in other words, that the change of intensity is not the immediate, but the mediate, cause of the phenomenon in question. He does this by showing in detail that the departure does not occur when the color match is looked at in a faint light, but with the eye unadapted to that light, and that it does occur when the eye is in a state of darkness-adaptation even though the illumination is not faint. But I feel sure that there is no one except Tschermak among those at all interested in the subject who has had the least idea that anything else than this was the case. Whatever may be the modes of expression which König and v. Kries sometimes make use of, it cannot for a moment be supposed that they have attributed the above-named departures to anything else than the state of adaptation of the rods of the retina. As far as they yield to the temptation to use the fact against the theory of Hering, they are certainly quite without any ground to stand upon. Nevertheless, this paper of Tschermak is of much importance as containing the first admission that has issued from Hering's laboratory, as far as I have noticed, of the fact of the instability of colorless mixed light equations, which was announced by myself in 1892 and by Ebbinghaus in 1893.

C. Ladd Franklin.

PSYCHOLOGICAL LITERATURE.

Social and Ethical Interpretations in Mental Development: a Study in Social Psychology. JAMES MARK BALDWIN. New York and London, The Macmillan Co. 1897. Pp. xiv + 574. Price, $2.60.

This volume, begun as a continuation of the *Mental Development in the Child and the Race*, has assumed, in the working out of the author's plan, a more independent character, and may be considered without extended reference to the former volume. The author has also aimed to make a book on social psychology which should be available for use 'in connection with courses in psychology, ethics and social science.' "This has led to such expansions—some may call them repetitions—of the fundamental ideas of the work as seemed necessary to a fairly complete working out of the social element in connection with each of the greater psychological functions." It is a question whether these expansions or repetitions do not tend to make the author's thought less easy to follow. The further fact that some of the sections have been published separately, while not necessarily an indication that they were not originally thought out as organic parts, may yet account for the difficulty felt in maintaining his orientation which a reader is pretty sure to feel in his first perusal. But the fact that it is doubtless much rather the author's purpose to be stimulating and suggestive than to be systematic and final indicates the point of view from which the work should be read.

Considered from this point of view, there can be no question as to the author's success. Whether the reader agrees or disagrees, he is certain to find many new and fruitful problems raised, much acute interpretation of common phenomena in the development of children and of society, and many a new standpoint for the consideration of ethical and social problems. The treatment of the genesis of a ocisal and ethical self, of social heredity, of social suppression of the unfit, of social judgment in its relation to art as well as to morals, of selective thinking, of the different stages in development of the emotions, of the successive types of desire, of the matter and process of social organization—to mention merely some of the more prominent topics—will probably not gain the complete assent of most readers to the author's

positions, but it will accomplish a better end in compelling them to rethink their own, and in bringing to their attention factors previously ignored. It may be assumed that the readers of this notice will all read the book itself, and so the purpose of the notice may best be served by a brief statement of its main principles, followed by a consideration of some fundamental positions which seem to need further analysis and development.

Leaving out of account the various more or less related topics introduced for pedagogic completeness, we may state the main problem thus: Man constantly acts with reference to a controlling standard, which while his own, in the sense that it is not external, is yet regarded not at all as private, but as authoritative for others and for himself just because it is so for any self—for self in general. How does such a conception of common reference arise? or, since a 'conception of self' is but another way of describing the same psychological fact, how does such a self arise? What is its content? Through what processes of thought, emotion, sentiment, volition does it evince its activity? What are its relations to those other contents of consciousness which I call *my* self and *thy* self, the *ego* and the *alter*?

As regards the method by which the 'general self' is built up, the thesis is that it is through a 'give-and-take' (or rather 'take-and-give') process, which forms a sort of 'dialectic of personal growth.' This dialectic has the three phases of a 'projective' stage of contemplation of other partially mysterious being or acts, a 'subjective' stage reached through 'imitation' of such beings or acts, and an 'ejective' stage of return-illumination of such beings or acts in the light of its own subjective experience. "My sense of myself grows by imitation of you, and my sense of yourself grows in terms of myself. Both *ego* and *alter* are thus essentially social, each is a *socius*, and each is an imitative creation" (p. 9). This means not only that others are understood, interpreted, judged, in terms of my own subjective experience, but also that I think of and judge myself in terms of an experience which includes others, as well as myself, and hence is conceived of no more as mine than as theirs. If it is asked then, how can I desire or strive for others, how sympathize with others, how judge others, and how assume a general standard for my own judgments upon myself (as in ethical judgments, *e. g.*, this is right)? the answer is that the 'others,' so far as I understand them or make them my objects in these acts, have all been and are still in most of their content 'me's.' "Whatever I fancy, hope, fear, desire for self in general, with no qualifications as to which self it is, remains the same whether afterwards I do qualify it

by the word 'my' or by the word 'your'"(p. 16). The very fact that my concept of others is 'ejective' makes it social, because common. The members of a family or a group will all naturally share in this process, and all will possess essentially the same concept of self, and therefore have, at least when opposed to other groups, nearly the same interests and standard of criticism. When we extend our consideration to the past as well as to our contemporaries we have the influences which are so inevitable as to deserve the name of 'social heredity' (pp. 57 ff.). When we consider further that society can use only such members as in some way fit into her process, we have the resulting doctrines (1) that the individual must be born to learn, and (2) that all the individuals must be born to learn the same things, principles directly contrary to 'Individualism' (pp. 71 ff.).

Moreover, this 'give-and-take' procedure is characteristic not only of the more predominantly imitative process of the mind; it is no less involved in the apparently contrary processes of invention. For invention is neither (*a*) a creation out of nothing, nor (*b*) is it a mere subjective fancy. As contrasted with (*a*) "the child's originalities are in great part the new ways in which he finds his knowledges falling together in consequence of his attempts to act to advantage on what he already knows," and as distinguished from (*b*) "the child's originalities are in great measure the combinations of his knowledge which he feels justified in expecting to hold for others to act on also" (p. 99). Invention is part of imitation in the broadest sense of the term, and the child's sense that some one else must accept it illustrates a real and necessary requirement (p. 113). This leads to the enunciation of the general criterion for the "selection of the valuable variations which remain as truthful thoughts in the mind of the child and the man," viz: "in so far as a personal attitude is involved in a judgment, in so far *the organization of the personal self is the ground of the selection of the particular thought as true.* And, further, when the self-thought is thus the nucleus of organization, *there the social criterion of truth must also be in force*" (p. 121). Language, play and art are treated as 'social aids to invention,' and illustrate forcibly at once the imitative factor and the appeal to social confirmation and approval.

So far we have considered the sources out of which the social self may rise, and have found them in the two fundamental processes of mental development; but what of this social self as ethical authority? This has its germs in the vague appreciation by the child of certain mysterious limits upon the conduct of even its parents. [But I am con-

fident that few children develop in such a favorable moral atmosphere as that of the children observed by the author. To many, if not to most, the parent is '*exlex*.'] It grows rapidly under the experience of obedience in which neither the habitual self nor the accommodating self, but a dominating other self, a new *alter*, determines the action. It gets conscious realization in the recognition of an atmosphere of family propriety, of accepted tradition (pp. 44 ff.). This is 'ejected', is made common law for all the group, and is the source of conscience, on the one hand, and of our judgments of others, upon the other.

Turning now from the genesis of the *socius*, in describing which we have considerably varied from Professor Baldwin's order, the points of chief interest in Parts III. and IV., entitled 'The Person's Equipment' and 'The Person's Sanctions,' are an interesting treatment of the emotions as related to the social self, and a discussion of the psychology of desire and will which suffers somewhat from being treated under several rubrics.

In the treatment of the emotions special attention is given to those emotions, such as bashfulness, or sympathy, which, in the author's opinion, have each an organic or instinctive and a reflective form at successive stages in the child's development. The organic form may well be a 'recapitulation' of some of the conditions of our animal ancestors as described by Darwin. The reflective form, if a 'recapitulation,' points rather to some conditions of a primitive human society. In particular, Professor Baldwin conjectures that at a certain stage of spontaneous and friendly confidence which he thinks he detects in children, interjected between the earliest organic bashfulness and a later more self-conscious and self-exhibiting stage of bashfulness,' has its parallel in the rest which man took after his release from the animal;' 'a scene like that depicted in the life of the Hebrew patriarchs.' This stage preceded the period of a more intense pursuit of self-interest which has its antitype in the later stage of reflective bashfulness. Since the author expressly declares the parallel to be only hypothetical, and takes pains to apostrophize just here the 'learned critic, whose red-rag instinct is keen for theory!' far be it from me to expose myself to such an apostrophe. But I must take an exception to the universal existence of the three successive stages in child-life, at least at or near the ages mentioned. In the case of certain children whom I have observed constantly up to the ages of three and four years no indications of reflective bashfulness have appeared, while in the case of certain others, not so closely observed, there never seemed to

be a time when they were not timid and ill at ease with strangers. I think that due allowance for size of families, training of children, playmates and many other factors of the immediate parentage or environment would explain most of these differences, but I am confident that they exist.

Mob-action is held to be neither an atavistic indication of the origin from which society has sprung, nor a warning of the goal toward which society is tending and a condemnation of democracy, but rather a by-product and intensification of features either good or bad in the life of individuals, 'an index of sociality rather than the cause of it, or its main outcome.'

The psychology of voluntary action is first sketched under the heading 'Intelligence' in Chapter VII., where the ends of action are classed as (1) impersonal or objective, (2) personal and subjective, and (3) social or ejective, corresponding to the epochs of thought, since 'the end is a function of the thought-content and it is by acting to realize ends that thought develops' (p. 263). The various triads are at times a little confusing, but the three epochs as named above are correlative to those named on p. 362 as (1) the spontaneous, (2) the intelligent and (3) the ideal or ethical, and the relation to the three stages named under the emotions is that (1) includes both the 'instinctive' and the 'spontaneous' stages, while (2) and (3) are subdivisions of the 'reflective.' Further we have as the 'sanctions' in these three epochs respectively, 'impulse,' 'desire' and 'right.' Instead of accepting any one of the theories that desire has for its end 'an object,' 'the enjoyment of an object,' 'enjoyment of self,' 'the self who enjoys,' 'self-realization' or 'the attainment of a better self,' the author holds that "every mature man of us has all these desires. And not only so; there are epochs of development which are characterized by one or other of these words, as then the great and prevailing sort of desire." The theories 'travel all the way from the object to the self' (p. 258).

Parts V. and VI. constitute Book II., 'Society,' and deal with 'The Person in Action' and 'Social Organization.' In the former the relation of the individual to society is described by the aid of a biological analogy. As we speak of variation and regression in biology, so we may think of the individual as the particularizing social force and society as the generalizing social force. [But the first seems of doubtful truth, unless we take 'individual' and 'society' in a merely numerical sense, and if so taken society is not a generalizing social force, for it may be maintained that in social and political development

the genius is preëminently the man who feels the situation most sympathetically and, therefore, reshapes the method of dealing with it. He changes things not because he is more particular, private, than others, but because he is more social.] Part of the chapter on social organization has appeared in the September number of the REVIEW, and maintains that the *process* of social organization is the twofold imitation process described at the outset in the dialectic of personal growth, while the matter or content imitated 'consists of thoughts, by which is meant all sorts of intellectual states such as imaginations, privileges and informations.'

I wish now to call attention to certain points in which to me, at least, there is need of further analysis:

1. The concept of the social self. Nothing is more exasperating to a teacher than to lecture for a month upon a given topic, and then be asked naïvely if he will kindly explain what he means by the conception which he has been elucidating and examining on every side for the hearer's instruction. But at the risk of being considered hopelessly stupid I will state my difficulty; and I can, perhaps, state it best by using a somewhat Hegelian distinction suggested by the author's own term 'dialectic.' Is the social or general self the outcome of the dialectic in such a way that both the *ego* and the *alter* must enter into it, and become *as such* elements of it, or is it conceived as merely the undifferentiated common raw material out of which *ego* and *alter* develop, but which does not include them? There is no place for extended quotation, but if the reader will turn to pp. 12, 16, 29, 80 and 294 he will find 'general self' used in a way which at least looks in the latter direction, while on pp. 264 and 266 we have an express statement of the opposite sort. Perhaps the note on p. 266 means that both the above alternatives are true and represent successive phases in the development of the social self, but if so the distinction is certainly not carried through with sufficient clearness to put it beyond doubt.

On p. 16 we read, 'whatever I fancy, hope, fear or desire for self in general,' from which we should infer that self in general had some content. But on p. 294 it is stated that 'this general notion of self is like all general notions considered as general, not a presentation, not a mental content, but an attitude, a way of action.' I do not believe that any one, least of all a child, ever hopes or fears for any such self in general, or 'attitude.'

To my thinking a more faithful way of considering the development is to conceive the child not as differentiating a common stock of

interests into egoistic and altruistic, but as beginning with a narrow, but rapidly widening circle of interests, centering at first chiefly in bodily 'feels' and impulses, in which parents and others figure merely as useful or agreeable parts of the situation. Not that he is reflectively egoistic; he is impulsive, and *ego* and *alter* are not yet defined as mutually exclusive ends. He mirrors in look or tone the joy or grief of others, but it is felt as his own, not as theirs. The interests are all *his;* the self as the subject of *interests* is and remains always *his own*, but its *content* comes to include not merely bodily 'feels,' but ends intellectual, artistic, spiritual. He advances to social and ethical life in the proper sense, when through the clear distinction or conflict between his own interests of the above narrower sort, and those of another recognized as such, his self increases in content and takes in parent or neighbor in such wise that their weal or woe *as such* becomes an interest. This larger self is then the social self. When in tension with any particular or partial group of interests it is the ethical self. The feeling of the tension is the feeling of oughtness. But it is not a self in general.

Professor Baldwin's doctrine is further complicated to my mind by the statement on p. 318, "The thought that the judgment passed is actually in the mind of some other is necessary to a full ethical judgment as such," and again on the same page, "It is not enough that I feel what others would say if they knew: *I must feel that others are judging because I judge.*" "To fall short of this is to think not in terms of the general thought of self, etc." In these passages the social self is apparently conceived numerically. The thought is similar to Professor Royce's view expressed in *Mind*, July, 1897, on the basis of which he holds causal conceptions impossible of application to psychological sequences because I cannot conceive any one else as observing my psychical states. In both cases it seems to me there is a mistake of taking a particular part of the *self-content* for the self, and so of denying the self to be really social.

2. Professor Baldwin makes little use of the conceptions of value in tracing the growth of the ethical self. The child's ethical self is supposed to be born almost entirely through the mediation of law and authority. But surely this is partial. I have been increasingly impressed with the element of truth in Mandeville's shrewd account of the training of children. It is largely by reiteration of the words, 'That is a *good* girl,' 'It is *naughty* to do so,' that we impress a sense of parental approval which constitutes, through association of tone and look, the mediated or modified value of the early acts, and

as this sense of the value gains in extent, to include the operation of acts upon a wider circle, the social and ethical self is in actual force. It mediates the transition from the heteronomy of obedience to an external authority to the autonomy of a really moral conduct.

3. Both the above-mentioned difficulties seem to enter into the treatment of the will. "Ends are a function of the thought content." I should say just as one-sidedly: "Ends are a function of the impulsive, desiring, forth-reaching motor-self." For no object is an end unless it is valued, and we must define value in terms of the organism which experiences it. Objects as 'things' (intellectually described relations) are never desired, never ends. This is excellently stated by the author himself as regards one stage of desire on pp. 378 f., where he distinguishes *a*, the object as desired, from '*A*, the hard and dry skeleton of rigid reality held in the grip of so-called mechanical law.' But it seems almost impossible that, as stated on p. 380, this same 'hard and dry skeleton' *A* should ever be the typical object of pursuit in the 'spontaneous' or 'objective' period of the child's desire. Surely the hungry child's object is not of this sort. If the hunger is purely the hitherto ungratified impulse, it cannot be said to have any object. If it has once found what will meet its wants, then this becomes its object, but the 'this' is certainly not an *A*.

Again, in the most developed type of desire, in which the subjective sanction or motive "is just the sentiment called 'ought,'" the value element is omitted. This sanction is compared to that of impulse. The person 'cannot explain his reasons for pronouncing conduct right; he has no reasons' (p. 395). This sounds like 'duty for duty's sake,' and is liable to the criticisms passed on Kant's theory of desire. There are doubtless persons who seem to act under the influence of just such a sanction, but I think the reply of a student of mine to the stock questions: "Is conscience infallible? Should one always follow it?" shows a more hopeful state of mind. She replied: "Conscience is infallible, but we should not always follow it; sometimes we should be guided by reason." I think Schiller was right in insisting that the good man *desires* his objects. The question is rather what self is it that desires? what self is seeking satisfaction?

4. The concept of imitation is used in a very wide sense. Where we speak of 'imitating thought' it is doubtful if we are not using it so broadly as to obscure the distinctive characteristic of apperception. But waiving this point, is not the process conceived too largely as an intellectual repetition without due consideration of the value factor in the determination of what is to be imitated and what neglected? This

seems to me to apply especially to the characterization of the matter and process of social organization. And, moreover, would the imitation of thoughts, as above defined, give rise to any real unity? Is it not rather community of ideals, of ends, of interests which is the essential thing? The author would hold, I suppose, that his view explains community of ends, since 'ends are a function of thought-content,' and if the content is common the ends must be. But because I should maintain that the thought-content, if defined as 'knowledges, informations,' etc., is by no means determinative of ends, but rather only a medium for achieving ends, I do not think the formula is adequate.

5. Finally, I may suggest that the function of 'work,' as well as play, in the development of social interaction and coöperation, and in the organization of both individual and community, might be worthy of a chapter in some future edition.

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Psychologie als Erfahrungswissenschaft. HANS CORNELIUS. Leipzig, B. G. Teubner. 1897. Pp. xv + 445.

Every effort at a reconstruction of any science is valuable in giving its indications of vitality in the particular field of inquiry. Somehow or other 'facts' are quite abiding. They aggregate into that constant which is usually called 'experience,' whether of nature or of selves. In many departments science becomes methods and devices. Psychology, while made anew in these latter days by the approaches of elaborate methods, is peculiarly susceptible to theoretical rebuilding. Erstwhile, this was its misfortune. Any writer might give us a 'system' of mental philosophy. Science is also a use of interpretative principles. In re-thinking these, reconstructions arise. In addition to its growth in facts and accuracy by experimental means, psychology is feeling afresh the symptoms of rejuvenation in the theoretical reconstructions which are being offered here and there. To some it is given to search for new material; to others, to plan for the distribution of this in accordance with the needs and limitations of interpretative insight.

In this volume is presented an elaborate reconstruction of psychological science in light of the basic principles which are offered as involved in the analysis of consciousness. It lays aside the current conception of psychology as an enumeration, exhibition and explanation of the facts of psychical life, and announces "its problem to be much rather that of the epistemological foundations of psychology;

the establishment of a purely empirical theory of psychical facts with an exclusion of all metaphysical presupposition" (p. iii). This problem is solved in terms of 'the complete and simplest comprehensive description' of these facts. The field of scientific psychology comprises 'the facts of the spiritual life, or psychical facts,' which are equivalent to the 'content of one's consciousness as directly known (1). In its scientific moods, psychology cannot admit the alleged causal element in knowledge, and must thus ever remain empirical in its character. All empirical explanation of psychical facts is regarded as exhausted and satisfied by a complete description given in the simplest manner (3–5).

In circumscribing the limits within which the author allows his movements to take place, he traces the genealogy of the special problem, linking it to the classic analyses of consciousness by Hume and James, to the empiristic efforts of Kirchhoff and Mach in eliminating the metaphysical concepts in physics, and to the epistemology of Avenarius and the criticism of Kant. In a similar vein he eschews the traditions of psychological history and opposes the 'atomistic psychology,' which starts from hypothetical sensations as simple elements, or as exhibited in the tenets of the associational school. Brain psychology—recognized as a separate field of inquiry—is opposed on account of its inadequacy to cope with the character of consciousness, which is conditioned (*sic*) by, but is not identical with, cerebral processes. The psychology of the individual—called 'pure'—thus is left as the object of primary investigation. Physiological and genetic inquiries are of value only so far as presenting material from indirect sources. With these limitations, 'this book gives only the principles (factors and laws) for solving the problems of pure psychology' (289).

The object, then, of the psychologist's inquiry is the content of our life, which appears ordered in a certain manner. This is a continuous process, its present factors only being given. Language is scarcely serviceable with its terms of 'events,' 'conscious content,' 'object of consciousness,' 'representations,' 'cognitive functions,' etc., to describe adequately this object with which this empirical science is to deal. "The word consciousness can have for us no other meaning than that of a general expression for the common characteristics of all physical facts. * * * We never discover any abstract 'consciousness,' but only concrete *contents* of consciousness" (16).

The scientific aim requires seven long chapters in dealing with this object. Chapter I. gives a brief analytical and descriptive picture of the fundamental facts of the psychical life. These are the content-wise

necessary and irreducible elements conditioning consciousness. Discrimination of successive contents, as in the case of sudden changes in the flow of consciousness, is the fundamental fact which underlies all recognition of the temporal course of our life. Successive and simultaneous contents implicate the fact of memory, which is an original datum, immediately distinguishable from impressions and sensations, and conditions the movement in consciousness through its immediate and unique assumption of 'a symbolical function.' Recognition of memory images is not reducible to simple data. The rise of a connected mental experience is absolutely dependent upon the function of these memory images. The recognition of, and association by, similarity are new elements given in consciousness. Association by continuity is reduced to the law of habit. Comparison and abstraction, while original facts, are forms or types of recognition by similarity. The course of experience is shapened by the symbolic characters which each state of consciousness assumes. Language is the chief form of this symbolism. Predication arises through similarity recognition in terms of the judgments of perception, and is always relative, except in perceptual concepts, which admit of deictic definitions only. Pleasure and pain are the primary facts of the feelings, which are not any particular factors in conscious content, but are rather the coloration of the total state of consciousness. The facts of willing, characteristic contents, are reduced to terms of wishing, desiring and feelings. These are the starting-points for empirical psychology, which can succeed in giving 'more exact determination of conscious content by a recognition of its relation to other already determined content' (69). Such are the elements, stripped of metaphysical terminology and conceptions, in terms of which the elaboration of experience is undertaken.

Equipped with these ultimate factors, Chapter II. presents the principles involved in the Continuity of Experience. This task is apparently easy, being satisfied with two, namely, the principle of unity, and expectation. The former is the fundamental law of the understanding, which has been recognized but dimly and comparatively recently in science. In terms of 'the principle of the economy of thinking,' it becomes the recurring ultimatum, throughout the volume, in the analyses of our concepts of things and the forms of our conscious experience. Expectation, a form of constraining association, is the origin of perceptions and illusions, of faith and knowledge. It is the preparation for the immediately future states of mind in terms of the experience past. On such a basis, it is maintained, consciousness

comes into possession of concepts of things as empirical products, and of objective existence, which goes back no farther in identification and definition than the notions of perceptions and the judgments of existence. This weaving of psychic contents issues in the distinction of subject and object, the unity of personality and the conception of other consciousnesses.

Chapter III., treating of Psychical Analysis and the Concept of Unnoticed (unconscious) Conscious-content, carries forward, in a more penetrating but less satisfactory manner, the analysis of succession, the origin of time, the complexity of simultaneous states, the preparation of one state for another, the secondary function of attention and the distribution of relations, the rise of the categories and the discrimination of numerical distinctions. That the end of psychological analysis is not easily reached, is evinced in Chapter IV., which renews the distinctions between Sensation, Memory and Phantasy. Their functions in the more complex elaboration of conscious experience are traced with greater detail. Sensations, however, are not considered in light of the views of an 'atomistic' theory which regards them in their fusions as accounting for the structure of conscious content. They are recognized 'as those factors of our experiences which do not arise out of the preparation' presented by the psychical states preceding those in which they are given (182). Does not this negative conception of sensation imply some casual explanation of the genesis of these factors of consciousness? Quite as much is inconsistently admitted a little later on.

The constructive merits of a purely empirical psychology are severely tested in Chapter V., which attempts to analyze the elements and processes involved in the production of The Objective World. The assumption of an external world of things is rejected as unbecoming a scientific psychology. This would entail a psycho-physical treatment of sensations in the beginning of an exposition. Relying upon the efficiency of the principle of economy to give rise to expectant judgments, and further, to lead to the formation of empirical concepts, the problem of objective things is reduced to the question as to how our notions of them arise. It is curious how some psychologists like to take to their heels, and run to Kant every once in a while, as does the author in identifying things and percepts (241). This chapter is mostly taken up with removing absurd or misleading conceptions gathering about the inner and outer, the place of consciousness, the nature of space, the assumptions of geometry, the objective conditions of consciousness, and the alleged fallacies in the axioms of psycho-physics.

While presenting many excellent analyses of affirmation and negation in one and in two consciousnesses, Chapter VI. is rather inconsequential in its attempt to deal with Truth and Error. How can there be error in empirical science, where all is mere fact and nothing more? Error in experience becomes an absurdity, like the square root of a minus, which can never be brought forward by any binomial theorem. The previous chapter having eschewed a *Ding an sich*, a really objective world for *psychological* purposes, there can be no error where mental facts are unable to come into comparison with facts of another order. The chapter, however, is suggestive in treating of the rise of judgments, the formal conditions of truth, the psychical materials of cognitive judgments, and the inductive processes for further elaborations. The author's analytical efficiency is not so constant in the closing chapter, which sketches the structures of Feeling and Willing, on the basis of the admitted ultimate factors of consciousness. The recognition of the feeling and judgment of worth, or value, is well noted in the elaboration of complex will in terms of moral and æsthetical values. The inability of a mere 'content' psychology to cope with the problems of the deed of will, is confessedly seen in the admission of the dependence of all activities on our *ego* (387).

The philosophical outcome of this analysis of consciousness is "naïve realism, * * * as the psychologically necessary, normal view of the world." This work is, doubtless, undertaken as a preliminary clearing of the field, and casts shadows before it in promising a future treatment of the connection it has with the Kantian philosophy, which appears ever and anon in these pages. This naïve realism is carefully distinguished from transcendental realism, too often the *bête noire* of psychical analysis. Thus the undertaking began by tethering psychological method, which gnaws its restraints until permitted to roam into the broader fields of metaphysical implications. The real value of the work is its renewed effort to reconstruct our science with the guidance of two or three principles, which are purported to be derived from the nature of the understanding on one hand, and from the inviolable nature of conscious facts on the other. The author has carried out this task with almost too much seriousness. One likes to expect more from scientific analysis than an exhausting delay in bringing forwards the points in exposition.

In attempting to avoid the mechanism of a sensation, or a brain psychology, this effort has fallen victim to the danger of running into the mechanism of a process psychology. Continual treading the air may be a wholesome exercise as such. But escape from a self-sup-

porting process is, at least, worth the rest that it might bring. We can credit the author with faithfulness in the attempt to free himself and the science from the harassing brigands dwelling in ontological caves. He has given us a model of patience in analytic explanations, too often absent in some psychological quarters. These fresh efforts, however, show us again that 'experience' is probably more elusive as fact and so concept than many of those metaphysical postulates against which some scientists are fighting shy. Analysts should guard against squeezing facts so hard as to leave them utterly dry when the analytical process has been brought to an end.

One of the most serious defects of the volume is its omission of all the increasing empirical data, gathered in the last two years by strictly scientific methods. The implication is that a science of experience becomes more a matter of logic than a matter of fact. Perhaps, after all, any science is only a sprinkling of logic over the few facts of a circumscribed field.

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Dynamic Idealism; An Elementary Course in the Metaphysic of Psychology. ALFRED H. LLOYD, Ph.D. Chicago, A. C. McClurg & Co. 1898.

A slight volume of some two hundred and fifty pages, elementary in its plan and written primarily with a more or less popular audience in view, this essay toward an appreciation, rather than a full understanding, of the metaphysical implications of psychological theory, does not demand the detailed notice which more assertive constructive work would call forth. A certain quaintness of terminology as well as a notable ethical enthusiasm for the unitary intuition which the author has found for himself, though at times not conducive to clearness, make the book attractive, and, on the whole, perhaps, more luminous than a more technical treatment could be. The author not only confesses himself one of those who insist upon the uselessness of psychology without metaphysics, but "goes to the extent of believing that real psychology is metaphysics," and, consequently, "when considering a psychological theory, is more interested in its relation to dualism or monism than in its more external details." It is, indeed, the program of the book to find a metaphysical monism implicit in a true psychological theory, and to this end current technical psychological theories are examined.

The dynamic and monistic mode of thinking Dr. Lloyd finds in-

separably connected, and dualism has as its presupposition formalism, which may be defined as an abstraction of the terms of a relation from the dynamical relation itself, which makes these terms independent entities. This interdependence of dualism and formalism is worked out in an interesting and subtle way: first, in the so-called world of things, and, secondly, in the sphere of ideas and will acts. In regard to the world of things contradictions inevitably follow this isolation of the terms of a dynamic relation. Thus the ordinary scientific dualism between the organic and inorganic, between mind and body, consciousness and environment, involve contradictions which are solvable only when the formal isolation which this dualism presupposes is superseded by a monistic theory in which the dynamic relations themselves are the actual substantial real. But science is not so bad as she appears, for the author finds in certain recent biological and psychological theories presuppositions which contradict this dualistic idea of environment. The substitution of one sense organ for another, the general relativity of all conscious states, are inconceivable, except on the hypothesis of one immanental intelligence in organism and environment alike. Environment is not 'alien,' but a 'living mediator.'

In the discussion of the 'World of Ideas and Will Acts' a somewhat different method is pursued, for a constant appeal is made to the bearing of a monistic or dualistic theory upon the mental and moral life. As a result an ethical idealism, in the fullest sense of the word, is developed. Ideas and will acts are, therefore, considered in their mediating worth. Here formalism and dualism are likewise one and the same, and they are brought about by an abstraction of ideas and acts from their relations in consciousness just as before organism and environment were abstracted, isolated. The particular interest of this second part centres about the metaphysical discussion of the dualism implied in current psychological theories of interest, attention, emotion and will activity. The author urges that the current distinction between feeling as essentially subjective, and interest and attention as objective in their reference, implies an isolation of consciousness and environment which is untenable. Consciousness is interest, including feeling and attention. Likewise, any temporal distinction between emotion and emotional expression, whichever he considered cause and which effect, must, in the light of experience, prove to be an untenable abstraction based upon a supposed dualism of soul and body. Emotion and expression are one and the same. Both the afferent, and the innervation theories of the will are subjected to the same fundamental

criticism. It is, however—and this is the point—chiefly from the practical, ethical standpoint that these theories are proven untenable, and to this end the chapters on historical and educational illustrations are original and important contributions to the general intuition of the book.

In forming an estimate of a work the plan of which is confessedly popular, and in which the method employed is more or less an ethical *argumentum ad hominem*, one should always have in mind what is left out! Consequently, while it cannot be said that the epistemological dualism which lies inevitably in the scientific standpoint is convincingly shown to be impossible, yet, as a general intuition of a monistic metaphysics, the book is enlightening. Of the metaphysical conclusions drawn from psychological theory one needs to be somewhat skeptical, especially since the author is not always quite clear as to what the psychological theory in question is. It scarcely appears how, for instance, "the existence of a distinct sense of motion is enough to refute the dualism of mind and matter, the physical and the psychical," for motion, as far as psychology is concerned, still remains a primary quality of *matter*. Nor is it likely that the temporal and causal distinctions which the author deplores in the current theories of emotion, feeling and will can be dispensed with in psychological analysis, even though they imply an untenable dualism. If the author had made clearer the relative validity of such scientific analyses, and then sought to show how they might be modified from an absolute standpoint, the argument would probably be more convincing. In general, however, one may properly doubt whether these theories themselves are definitely enough formulated to admit of any far-reaching metaphysical conclusions.

WILBUR MARSHALL URBAN.

PRINCETON.

Einfühlung und Association in der neueren Aesthetik; ein Beitrag zur Psychologischen Analyse der Aesthetischen Anschauung. PAUL STERN. Hamburg and Leipzig. 1898. Pp. 81.

This monograph, the fifth in the series edited by Theodor Lipps, is equally valuable as a historical study of the development of the psychologizing tendency in modern German Æsthetics and as a critical study of the merits of the controversy between the metaphysical æsthetic with its symbol-concept and the psychological Association theory. Dr. Stern finds the beginning of the subjectification of the æsthetic problem in the Romantic school, which rightly sought the explanation of the æsthetic in the sphere of the feelings. 'Der Einfühlungs

Gedanke,' the notion that the æsthetic intuition is in its essence a reading of our feelings and emotions into the object, is to be found throughout the writings of Jean Paul, Novalis and Schlegel.

Within this early school, however, the symbolic character of the object rather than a psychological analysis of the symbolizing processes was the main problem. Not until the careful analyses of Fr. Vischer and Lotze brought the subjective æsthetic act into the foreground was the psychological standpoint, implicit in this notion of romanticism, set over against the symbolic. Robert Vischer continues the psychologizing tendency.

Later formulations of this subjective principle of 'inner nacherleben,' the successor of the 'Einfühlungs-Gedanke' of the Romantics, is traced in the theories of Siebeck, Biese and Groos. Especially in Groos is the more psychological aspect of the problem separated, but, as the writer points out, by means of an unwarranted abstraction. The æsthetic intuition is supposed to consist of an 'inner imitation of the sensational act rather than of the object of the sensation. But psychical acts are obviously merely explanatory hypothetical terms, and not immediately given psychological data to be imitated.

This entire development of the psychologizing tendency in æsthetic is an attempt to give a technical psychological formulation to this, originally, more than psychological concept of 'Einfühlung.' But the difficulty of exhausting the content of this notion by means of the ordinary laws of psychic mechanism leaves symbolic idealism still in the field. Volkelt's criticism, from this standpoint, of the Association principle, as formulated by Fechner, is in turn subjected to criticism by Dr. Stern. He shows conclusively that Volkelt's objections rest upon an untenable doctrine of association itself; the development of the true doctrine of association (along the lines of Lipp's psychology and æsthetic) being sufficient to account for the 'innerlichkeit' in the æsthetic psychosis, for the explanation of which Volkelt and the idealists in general require a doctrine of metaphysical symbolism. Association is then the technical psychological expression for the old 'Einfühlungs Gedanke.' Dr. Stern has given a clear presentation of this standpoint, but those who think that association does not explain the æsthetic psychosis might properly object that in getting away from the formalistic theory of association he has gone too far in the other direction. When the association which constitutes the condition of the deepening of unæsthetic to æsthetic feelings is an identity association which sets the entire psyche in resonance and brings about a sympathetic modification of the feeling of self-worth, too much is asked of association.

WILBUR MARSHALL URBAN.

VISION.

Ueber die Farbenblindheit der Netzhautperipherie. J. von Kries. Ztsch. f. Psych. u. Physiol. d. Sinnesorgane, XV., 247–289. 1897.

Professor von Kries has had the good fortune to make several important additions to our knowledge regarding the nature and the distribution of the functions of the retina. He defends with activity the hypothesis that the rods are distinctly different in function from the cones, and he discusses acutely the bearing of this fact, as it may rather now be called, upon the different theories of color vision.

The content of his present paper is to establish that the achromatic vision which is all that the normal eye can boast of in the periphery is not the same thing as the achromatic vision of a faint light; this is apparent from the fact that the relative brightness of the spectrum throughout its length is not the same in the two cases. It is, therefore, also not the same as the vision of the totally color-blind, since that corresponds with the vision of the normal eye in a faint light. v. Kries has adopted the term *twilight vision* for this latter form of sensation; *night vision* would be rather better, because twilight suggests a light which is somewhat too strong for a complete adaptation to have taken place, and also because the term *night blindness* is already in use to denote the defect of this sensation. In correspondence with this, I shall say *daylight vision* for what v. Kries refers to as brightness-adaptation vision. The contribution made by this paper of v. Kries may then be re-stated in these terms: the peripheral daylight vision of the normal eye, though it is a form of gray-vision, is not the same thing as the night-vision of the normal retina nor as the gray-vision of the totally color-blind. When stated in this way, it is evident that this is nothing but what any one at all conversant with the facts of vision would have known perfectly well beforehand to be the case. The adaptation to a faint light which takes place at the end of twenty minutes is beyond question due to the growth of the visual purple; for its quantity-distribution along the spectrum is coincident with the absorption distribution of that pigment; but in a bright light the rods of the periphery are, like all the other rods of the retina, destitute of that pigment, and it would be very queer if no change should be made in the relative values of different lights by the presence or absence of so distinct a colored medium of absorption as is the rod-pigment.

v. Kries regards his result as telling strongly against the theory of Hering, but that is not the case; and Hering's theory has a sufficient

load of difficulties to stagger under without adding unnecessary ones to its burden. No one can discuss the theory of Hering in safety hereafter without reckoning with Professor G. E. Müller. Professor Müller has given a powerful defense of the theory, freed it of several of its absurdities, and put it into a very different condition as regards acceptability. In particular, he anticipates in the most distinct terms the observation which has now been made by v. Kries. He says: "A determination of the white-valences of the colors by means of the peripheral color-blindness, if carried out in the condition of complete brightness-adaptative, and if results of sufficient accuracy could be obtained in this condition, would give the white-valence of a high light [and not those of normal night-vision nor of the ordinary cases of achromatic vision]."[1] It seems odd that v. Kries should not have taken the trouble to read this important series of memoirs of Professor Müller. It must be added that Professor Müller gives conclusive reasons for believing that most color-blind persons have an unusually large amount of rod-pigment in their retinas (they are excessively dazzled in a strong light, require only a short time for complete darkness-adaptation, etc.); this is a simple means for accounting for the fact that their gray-vision does not change very much in distribution with change of illumination, and corresponds even in a bright light with the *night* gray-vision of the normal eye. The well-marked instances of color-blindness in which this is not the case are also instances in which the reasons just referred to for believing the rod-pigment to be excessive in amount are not present.

Nevertheless, as is intimated by Professor Müller, the experimental testing of the peripheral gray-vision presents some difficulties, and it is well that it has been carefully carried out. The method, for papers, was the same as that employed by Hess—a colored paper was looked at so peripherally as to appear to be colorless through a hole in a white screen, and the illumination of the screen was varied until the hole could no longer be distinguished from it. A similar method for homogeneous light was worked out by means of the collimator tube from the big Helmholtz color-mixing apparatus (the slit of which served to vary and to measure, in this case, the brightness of the spot of light) and a Wernicke fluid-prism. (It was noticed that with

[1] Unless one is a pronounced Heringite, it seems rather odd to talk about the *white light* which can be perceived under circumstances in which the darkness is so great that one can only just see to move about, and that colors are no longer visible. The appropriate term for this—and the artists have already consecrated it to the purpose—is *a gray light*.

spectral lights the hole could not be made to absolutely disappear, but—most markedly for red light—it presented, when almost invisible, an appearance resembling that of metallic lustre—it seemed to be in parts too bright and in parts too dark.) It was found in this way not only that the peripheral gray light of the normal eye has a *different* distribution of brightness along the spectrum from the gray light of the normal night vision, but also that it has the *same* distribution as the colored light of the ordinary illumination. This, also, is what was to have been expected; Professor Müller has already independently seen reason for believing that it would be the case, and it is a matter of deduction from the assumptions of my theory. The way in which Professor v. Kries speaks of the function of the rods is in fact difficult to understand; he seems to regard the darkness-apparatus, as he calls it, as continuing to work side by side with the cones in a bright light in a fashion quite unchanged from its functioning in a faint light—as if the fact that the visual purple is quite bleached out in a bright light were a matter of no consequence. Professor Müller adopts my hypothesis that the visual purple is not the substance whose chemical decomposition affects the optical nerve-ends, but that it acts as an absorbent of light when the illumination is insufficient. It goes without saying that since it is purple in color it absorbs the green portion of the spectrum superabundantly, and it follows from this that the spectrum must appear subjectively much brighter in the green with the visual purple than without it. But v. Kries distinctly assumes (especially in explaining the metallic lustre above referred to) that the work of the rods is unchanged in light and in darkness.

It was also made out that the normal dichromacy of the middle zone of the retina is of the kind now known as deuteranopia (what was formerly called green-blindness), and that it differs markedly from the so-called red-blindness, or protanopia. [The slight differences which seemed to exist between it and the vision of the green-blind person are perfectly well accounted for on the supposition that the rod-pigment is more readily formed in the retina of the dichromates than in the normal eye; they were differences in brightness only and not at all in color.]

While all this does not work against Hering's theory in its essential features, it is, of course, totally destructive of his views as to the specific brightening powers of the different colors. But then those views were already completely demolished as soon as it was announced that a gray mash of blue and yellow, and a gray mash of red and green,

if equally bright at one intensity, are not so at a widely different intensity. Hering introduced the idea of specific brightness as a means by which to explain (in words at least) the Purkinje phenomenon. The above experiment extended the application of the phrase; the Purkinje phenomenon had before been known as a property of colors; it was now seen to be a property of colorless sensations as well, when produced by differently constituted ether-vibrations. It followed that it was not only not explained by the idea of specific brightening powers of color-sensations, but was incompatible with that idea. Hering ought to have accepted at once, and with pleasure, the discovery of König that night-vision is rod-pigment vision, for it enables him to escape from the slough of despond into which he is plunged (if his feelings are logical) by the extended Purkinje phenomenon.

As practical conclusion, v. Kries points out that the oculist, in testing for color fields, gets very inaccurate results if he does not make use of the invariable red and green—the colors which become gray as they approach the periphery, without showing any traces of yellow or blue (he confirms the observations of Hess, that there are such colors) and also of colors which have equal achromatic value in the periphery. The colors of Hegg, of course, fulfill those conditions, besides being chromatically equivalent. How far their lack of saturation is a disadvantage is not yet known. Fortunately, the form of equal white-valence, so-called, which Hegg determined was equal periphery value instead of equal night value, at a time when it had not been noticed that they were not the same thing.

Experimentale Untersuchungen über die Nachbilder bewegter leuchtender Punkte. PROF. C. HESS in Marburg. Arch. f. Ophthal., XLIV. (3), 445.

This paper is a criticism of a recent communication by v. Kries on the after-effects of brief retinal excitations (see this JOURNAL, Vol. III., p. 695). Hess finds that v. Kries is in error in thinking that there is no secondary image after a momentary excitation in the fovea. v. Kries describes the ghost-like attendants which follow a moving light, and says his observers likened their disappearance when the moving light crossed the fovea to a 'slipping into a tunnel." Hess points out the sources of error in v. Kreis' experiments (fatigue, when the image of the moving light rotates within so small a space as the fovea; insufficient brightness of the source of light, when the smallness of the image is secured by the observer moving farther away; and, worst of all, the

disturbing influence of a bright point which is directly looked at for securing fixation). With these sources of error properly combined, Hess is able to produce the slipping into a tunnel effect in parts of the retina outside of the fovea; and upon avoiding them he has no difficulty in detecting the foveal secondary image. Instead of a moving light as the source of the original sensation, Hess prefers a fixed light, which appears and vanishes with the opening and closing of a photographic shut-off. With this arrangement, and with the fixation of the imaginary mid-point between two small phosphorescent bits of paper, Hess gets a foveal series of after-effects which run their course exactly the same as those of a (simultaneously seen) peripheral one. v. Kries will doubtless say that this method errs in the opposite fashion, by not securing sufficiently exact fixation. But that objection will not apply to the next method of Hess, in which his original excitation is secured through a large number of small holes in a piece of black card-board. When this group of holes is looked at, some one of their images must have now and again fallen upon the fovea, but there is never any lack of the characteristic secondary image.

As regards the color of the secondary image which follows a color-excitation, very contradictory accounts have been given by different observers. v. Kries affirms that it is of the same color as the original excitation; Bidwell says that it is always violet, and Hess maintains here, as he has done before, that it is of the complementary color. As a simple means of exhibiting this, he lets a colorless source of light move through the visual field, and at a certain part of its course pass behind a piece of colored glass. The secondary image of this colored portion can then be readily compared with the colorless lines on either side of it; it is always found to be distinctly of the color complementary to that of the piece of glass. Even red glass which lets through light of no greater wave-lengths than 623 $\mu\mu$ gives its secondary image; if this is so, v. Kries exaggerates the lack of effectiveness of red light. Hess also disagrees with v. Kries' account of the change in the phenomenon produced by a long darkness-adaptation. The preceding negative phase is all that v. Kries sees here; Hess sees the regular secondary phase equally well, and cannot understand why v. Kries has apparently failed to detect this negative phase in all the *other* conditions under which he has experimented. Hess has all his apparatus put up by the side of his bed and tries his experiments when he wakes up in the night—that is, after a total darkness-adaptation of from four to six hours or more. He finds, aside from a much greater brightness and a much less saturation, no

difference between the effect under such circumstances and after the ordinary exposure of the eye to light.

Hess dwells upon the utterly illogical predicament in which v. Kries finds himself in the present stage of his thinking upon color-sense theory. (See also this JOURNAL, III., 72, 73.) v. Kries admits the existence in the *rods* of some chemical process which gives us the indiscriminate sensation of gray throughout the spectrum; but so far as the *cones* are concerned he is still a devout Helmholtzian—that is, he believes that the gray sensation furnished us by them is a recomposition by the judgment of an even red-green-blue sensation. To say that it is not in consonance with the fundamental psychophysical principle to suppose that our Psyche is so stupid as not to be able to detect the difference between a *real* white as furnished us by the rods, and an *imaginary* white as constructed for us by the judgment, is to express in polite terms what might be more forcibly described as arrant nonsense.

C. LADD FRANKLIN.

Ueber das Purkinje'sche Phänomen im Centrum der Netzhaut. F. D. SHERMAN. Philosophische Studien, XIII., 434–479. 1897.

It has been claimed by Parinaud and by von Kries that in the center of the retina, where there are no rods, the Purkinje phenomenon does not occur. Sherman tested this with eyes adapted both for light and for darkness, using for the purpose light shining through sheets of gelatine, either fixed or in rotation. He sums up his results as follows:

(1) The Purkinje phenomenon can be seen in the center under the same conditions as in the periphery. (2) The loss of color cannot be attributed to the action of the rods in indirect any more than in direct vision. (3) In the center of the retina sensitiveness to red is greater than to blue, and toward the periphery their thresholds fall nearer together; corresponding to this fact, greater intensity and larger surface are more favorable to blue and green than to red in the center, but are equally favorable to all in the periphery. (4) The color-thresholds are somewhat raised in the case of twenty minutes' adaptation to darkness and in indirect vision, but the loss of red is greater than that of green and blue. (5) An adaptation for colors exists in the center, fitted to bring about their perception in the case of adaptation for darkness in the same measure as in case of adaptation for light; there exists also probably an approximately similar tendency to adaptation in the periphery. At any rate, adaptation for darkness does not change the relative proportion of red and blue which holds for adaptation to light.

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Matière et Mémoire: Essai sur la Relation du Corps à l'Esprit. HENRI BERGSON, Docteur ès Lettres, Professeur de Philosophie au Lycée Henri IV. Paris, Alcan. 1896. Pp. 279.

Professor Bergson here grapples with nearly all the graver problems of psychology, epistemology and ontology, handling them in a manner which is often both original and suggestive. His point of view, however, is so widely removed from those now in fashion that it is not easy to find conceptions made to hand in which to characterize it.

Professor Bergson proclaims open war upon all the schools into one or the other of which we usually suppose a man will find himself led even after ever so earnest an attempt at originality. Natural realism, materialism, idealism, criticism, associationism, conceptualism, nominalism—all are met with the same uncompromising rejection. In their stead he endeavors to construct a new psychology, a new metaphysic, to evade the pitfalls into which others have fallen and to gain a true view of reality as it is.

To Professor Bergson all reality is akin in essence to the actually given in consciousness, but he is far from restricting it to that which is actually given in consciousness. There exist two worlds of reality. The world of matter, or, as Professor Bergson terms it, in order to connate its essential identity with mind, of 'images,' is characterized (23) 'by the necessity under which (every element) lies of acting at all its points upon all the points of all other images, of transmitting the totality of that which it receives, of opposing to each action an equal and contrary reaction, of being in fine but a path over which pass hither and thither the modifications which traverse the immensity of the universe.' Matter consists of qualities; these qualities are all extended, and their extension is the common element which binds them together into a unity (242). Matter is not subdivided into individual bodies (218), is capable of real motion (214–217), and its constituent qualities vibrate (225–233) at rates which, although too rapid to be sensible, have been detected by science and have given rise to the myths of atoms and ether. 'It parades on the surface its immobility, but it lives and vibrates within' (228).

The other world of reality is that of memory. In memory the entire past of the individual continuously exists, whether present to consciousness or not (152–161). It is manifested in two forms. The one is motor, and consists of reflexes, habits, etc.; the other, memory proper, consists of 'image-memories' (75).

These two worlds come in contact at one point only, and the

blending of the two at that point constitutes experience (164–166). The function of consciousness is to bind together by one continuous thread of memory an uninterrupted series of instantaneous visions which constitute parts of things rather than of us (58). But this 'point' is not a mathematical point—it is rather a section or area of which the body is the constant center, 'the perpetually renascent portion of experience' (164); holding a privileged position as regards the other elements of experience. Indeed, the very appearance of the latter varies with the practical significance of their relation to the body; 'they reflect its possible action upon them' (5). Moreover, although the body is 'an image among images' and is in part subject to the laws of the 'image world,' it is also a center of true origination of action; in it only is the causal nexus broken (2).

Experience thus contains two components, one derived from memory and one from the image world. But these components aré not merely conjoined—each profoundly modifies the other.

Perception may be described as a process, 'a continuous becoming, not a discontinuous multiplicity of inert and juxtaposed elements' (144), as a 'circuit' (107), one pole of which lies in the world of 'pure' or 'potential' memories, the other in the world of images. The process may be initiated from either pole, but, however initiated, it induces a reaction, involves a continuous flux and reflux of those elements whose blending makes experience.

Viewing the process from within, the 'pure' memory first becomes visible to consciousness as a nebulous mass, develops into an 'image-memory,' a sensation, an experience (144); viewed from without, it is no mere expansion of a few scattered sense data into a coherent manifold, but is rather a restriction, a limitation, a condensation of the manifold complexity of the image world within the narrow compass of experience. As a beam of light in passing from one medium to another may be in part reflected and in part refracted and transmitted, so the elements of things which interest the active element in these centers of real origination which we call our bodies, are reflected and constitute the world as we see it—a species of mirage (25). The unbroken flow of images is, by the infusion of memories based upon practical needs, condensed into different qualities and broken up into distinct things (233–44).

In the midst of this circuit lies the human body. It is a motor instrument, a conductor, a central exchange for the reception and analysis of afferent impulses—it is nothing more (17). The processes of the cortex are in no sense the physical basis of consciousness.

'They but mark, like a pendulum displaced, the relation of my body to other bodies,' and prepare its reactions (8–9).

Professor Bergson, in brief, attempts sharply to discriminate the sensory from the motor functions, representing the former as consisting in a free ebb and flow between an inner and outer conscious reality, while he limits the function of the body to the production of motion. Clearly such a division brings him in conflict with the whole mass of evidence which goes to show that the sensory and ideational as well as the motor functions depend upon physical conditions. To meet the difficulty he undertakes a review of the evidence, and examines the phenomena of hallucinations (32), section of nerves (33), education of the senses (36), specific energy of nerves (40), feeling, especially pain (43), illusions of localization (51), recognition, attention and association, with especial reference to speech disturbances (73–140), and concludes that the facts bear out his conclusions.

The details of this reasoning could scarcely be given within the limits of a review, but a few illustrations may be of interest.

Section of a nerve destroys perception because, the function of the nervous system being to bring the center of indetermination into connection with the real world, its destruction makes perception useless, and 'it is precisely in that uselessness that unconsciousness consists' (33).

Pain is due to the fact that the afferent side of the nervous system has lost its proper motor functions; when a stimulus is injurious to the afferent elements concerned, pain arises (47)—it is 'the effort of the injured element to replace matters, a sort of motor tendency in a sensory nerve.'

In recognition, attention and recall the relation of the nascent motor processes induced by the environment to the motor tendencies of the nascent memory is the key to the situation. The mere consciousness of such nascent motor processes constitutes recognition (94). When they do not quite coincide with those of the memory the latter may be thrown back upon itself, thus eliciting successive waves of memories and enriching the total content of consciousness. Taken as a whole this is attention (104). But the special memories which are to respond are determined by the affinity of their motor tendencies to those of the environment (105). Hence all loss of memory is to be explained as due to impairment of the motor function.

Notwithstanding the often luminous insight which marks Professor Bergson's polemic against scientific orthodoxy, he cannot be said to have improved upon it. Facts are stubborn. Whether we admit that

cortical processes directly condition sensation and ideation, or describe sensation as lapsing because it is of no use after the destruction of the nervous mechanism and interpolate as the proximate condition of ideation a motor process, itself physical, matters very little. The former mode of speech puts the facts plainly; the latter befogs the issue. In their essential features Professor Bergson's doctrines are not novel; they are merely confused; and when the confusion is cleared away, the old problems again confront us unchanged.

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PHYSIOLOGICAL.

Das leitende Element des Nervensystems und seine topographischen Beziehungen zu den Zellen. STEFAN APÁTHY, in Kolozsvàr. (Part I.) "Mittheilungen aus der Zoölogischen Station zu Neapel," 12 Band, 4 Heft. Pp. 495–748. 1897.

This comprehensive monograph details the important results of research in neural histology carried on by Profsssor Apáthy in the years preceding 1896. It is to be followed by a second part 'as soon as his other scientific duties will allow.' It is a well-written work of 254 pages, and is embellished by ten elaborate plates composed of eighty-nine most interesting drawings, some of them in colors. The investigation was made chiefly upon the neural systems of the leech and earthworm and the mussel, snail and crayfish among invertebrates, and upon the vertebrate newt, frog, *Lophius*, rabbit and ox. The sections for the microscope were stained by several different methods, most valuable of which, he considers, were his own Gold-chloride-and-formic-acid and his Methylin-blue methods. Many pages of the work are devoted to the elaborate details of his various staining processes, and form an important portion of the monograph.

Perhaps the thesis of the work most interesting to psychologists may be conveyed in the following paragraph from page 507: "The Ganglion-cell is thus in a manner inserted plainly in the neural conductive path just as is a single energizing element of the galvanic battery in the uninterrupted course of the telegraph wire. The *Ganglion-cell produces that which is conveyed; the Nerve-cell* (proper) *that which does the conveying:* a division of labor which has differentiated the originally and phylogenetically similer cells, the *Neuro-ganglion-cells*, with both functions at once, into these two forms of cells histologically and histogenetically different. But the *Ganglion-*

cells give forth not only a constant stream, the tone, but they react also in perception, which by external influence, the stimulus, causes a change of the tone with further quantitative and perhaps also with qualitative alterations in themselves. Meanwhile it is very possible that the nerves themselves also, stimulated by changes in the current originated outside of themselves, may have on them a certain *secondary* influence. *A qualitative influence*, an adaptation, in a way (in the case of artificial stimulation, *vitaliziug*) for the intended function (*e. g.*, on a muscle), seems to me most probable." The ganglion-cell furnishes to the neural current nervous force just as the muscle cell produces contractile force.

Another respect in which Dr. Apáthy's discoveries and theories will, if confirmed, supersede our present neuron-theory, is seen in the declaration that the primitive conducting fibril continues in unbroken continuity from the nerve-cell perhaps through several or many ganglion-cells to the periphery, not, however, without invariably breaking up within the soma of each ganglion-cell into a reticulum of yet finer threads which combine on the further side of the cell to constitute again the fibril, but having meanwhile received, perhaps, minute additions from some neighboring cell. Thus the neural fibril is an outgrowth of the proper nerve-cell, and gets its force from the ganglion-cells only, these latter serving as do our telegraphic relays.

The forms of anastomosis between *ganglion-cells* observed by Dr. Apathy are classified by him as follows, in five groups: (1) Two cells send a projection into the same nerve fibre; or both lie on the same nerve fibre. (2) The projections of two (or more) cells are connected with one nerve fibre; or one cell lies on the projection of the other, thus evidently combining with it. (3) The cell-body of one cell is bound to that of another by a sort of bridge projection; or two or more cells are firmly bound together in a close group; or are entirely fused together; or lie in an often horseshoe-shaped group. (4) Two cells are united by projections made up of either side- or end-branchlets. (5) The projections of two cells, after repeated branching, connect in the form of a network.

We have now suggested, perhaps, the chief theses of this investigation. Altogether this work is a report of elaborate and most careful and patient research in a direction much in need of such thoroughly scientific treatment as Professor Apáthy has given the world in this monograph. It is by such labors that we shall sooner or later learn, if at all, the physiological processes concomitant to psychical action.

GEORGE V. DEARBORN.

Studies in the Psychology of Sex. Vol. I., Sexual Inversion. HAVELOCK ELLIS. London, The University Press, Watford, 1897. Pp. xvi+204.

The German edition of this handsome volume has already been noticed in this REVIEW (Vol. IV., p. 447). Dr. Ellis says in his Preface to the present edition: "The German edition contains some matter which has finally been rejected from the English edition as of minor importance; on the other hand, much has been added to the English edition, and the whole carefully revised." The omissions seem to include all the matter contributed to the German work by J. A. Symonds (one essay by him, on 'Homosexualität in Griechenland,' being 90 pages long), whose name was then given as joint author; in fact, there seems to be no allusion to Symonds in the whole volume, though much was made of his coöperation in the preface to the German work. J. M. B.

PEDAGOGICAL.

Suggestions for a Philosophy of Education. A. CASWELL ELLIS. The Pedagogical Seminary. Vol. V., No. 2. October, 1897. pp. 159–201.

Positing the thesis that until we are in possession of a philosophy comprehensive enough to explain all the facts of the psychic universe we are not in a position to construct a complete philosophy of education, the author undertakes a rapid survey of the bearings of the more recent discoveries in biology, physiology, anthropology, psychology, and child study on the problems of educational science, in order to indicate the lines along which a 'larger and truer future philosophy of education must be developed.' "The problems of pedagogy are shifting from a search for the shortest method of giving the knowledge supposed to be necessary for adult life, to an effort to find the outlines of the different periods of psychic development, their demands, laws of growth, and relation to succeeding stages."

Hence are briefly discussed the scope and limitations of the recapitulation theory and of parallelism, the educational truths contained in recent investigations on periods of mental and physical development in children, the phenomenon of psychical atavism, play, the relation of the school and the home, religious training, specialization in study and in teaching, and physical education, and the probable significance of these various factors combined in the construction of a broader and more rational pedagogical system.

GEO. B. GERMANN.

COLUMBIA UNIVERSITY.

Des Gedächtnis. FRANZ FAUTH. Berlin, Reuther & Reichard. 1898. Pp. 88. Price M. 1.80.

Sammlung von Rohandlunger aus dem Gebiete der pädagogischen Psychologie und Physiologie. Herausgegeben von H. Schiller und Th. Ziehen.

This very admirable little book is an attempt on the part of pedagogics to give in a concise and clear but thoroughly scientific form the results of psychological investigation of memory and to apply them in a general way to the problems of education. Although the treatise is not a contribution to psychological research its clearness and its thoroughness should commend it to teachers and others interested in pedigogics.

F. KENNEDY.

The Application of Psychology to the Science of Education. JOHANN FR. HOBART. Trans. & ed. by B. C. MULLINER, with preface by D. BEALE. New York, Scribners. (Imported.) 1898. Pp. CXXV +226. $1.50.

This is a valuable addition to the hand-apparatus of the Herbart movement. The letters of Herbart are important and the translation seems very good if we except certain renderings, as 'Mind-faculty, for *Seelenvermögen*; on the other hand, the rendering 'Spontaneity' for *Selbstthätigkeit*, seems to us truer to Herbart than the current self-activity. The introduction is somewhat long-drawn-out by poetical quotations and a certain vagueness characterizes it, and as it also does Miss Beale's preface. For example, in the latter we read: "The enormous progress made in physiological psychology by means of histological research * * * has shown how large is the field of exploration; and the more the true theory of apperception is studied, the more apparent will become the marvelous adaptation of the intelligence of man to the intelligible universe, the more the relation of the individual to the universal." What, pray does that mean? For psychologists, at least, Herbart would better to be left to speak for himself!

J. M. B.

NEW BOOKS.

Névroses et idées fixes. I. PIERRE JANET. Paris, Alcan. 1898. Pp. 407.

Beiträge zur Akustik und Musikwissenschaft. Heft I. CARL STUMPF. Leipzig, Barth. 1898. Pp. vi+108.

Dynamic Idealism. An Elementary Course in the Metaphysics of Psychology. A. H. LLOYD. Chicago, McClurg. 1898. Pp. vii+248. $1.

Das Gedächtniss. F. FAUTH. Samml. von Abh. päd. Psychologie. Bd. 1, Heft 5. Berlin, Reuther u. Reichard. 1898. Pp. 88. M. 1.80.

Einfühlung und Association in der neueren Aesthetik. P. STERN. Heft V. of *Beiträge zu Aesthetik* of Lipps and Werner. Hamburg u. Leipzig, Voss. 1898. Pp. 81. M. 2.

Wesen und Aufgabe der Sociologie. LUDWIG STEIN. Abdruck a. d. Arch. f. System. Philosophie, Bd. IV. Berlin, Reimer. 1898. Pp. 38. .60 M.

La fatigue intellectuelle. A. BINET and V. HENRI. Bib. de Ped. et des Psych. Paris, Schleicher Frères. 1898. Pp. 338.

The Applications of Psychology to the Science of Education. JOHANN F. HERBART. Trans. and ed. by B. C. MULLINER, with preface by D. BEALE. New York, Scribners. (Imported.) 1898. Pp. cxxv+226. $1.50.

Del Potere di Inibizione: Nota di Pedagogia. G. A. CALOZZA. Roma, Parovia. 1898. Pp. 128.

Évolution individuelle et Hérédité. F. LE DANTEC. Paris, Alcan. 1898. Intern. Sci. Series. Pp. 308.

The Study of Children and their School Training. F. WARNER. New York and London, Macmillans. 1897. Pp. xix+264.

The Social Mind and Education. G. E. VINCENT. New York and London, Macmillans. 1897. Pp. ix+155. $1.25.

Studies in Philosophical Criticism and Construction. S. H. MELLONE. Edinburgh and London, Blackwood. 1897. Pp. xxii+426. 10.

L'Individualité et l'Erreur l'individualiste. F. LE DANTEC. Paris, Alcan. 1898. Pp. 175. Fr. 2.50.

Les Éléments du Caractère. P. MALAPERT. Paris, Alcan. 1898. Pp. xvi+302. Fr. 5.

L'Individu et la Réforme sociale. E. SANZ Y ESCARTIN. Tr. from the Spanish by A. DIETRICH. Paris, Alcan. 1898. Pp. viii+390. 7.50 fr.

Psychologie du Peuple Français. A. FOUILLEÉ. Paris, Alcan. 1898. Pp. iv+391. 7.50 fr.

NOTES.

PROFESSOR WM. JAMES, of Harvard University, has been appointed Gifford lecturer to the University of Edinburgh for the years 1899–1901. He will give two courses of ten lectures each on 'Natural Religion.' Professor James has also been elected correspondent of the Institute of France (Acad. des Sciences morales et politiques).

DR. CHARLES DE GARMO, President of Swarthmore College, has accepted the chair of the science and art of education at Cornell University.

PROFESSOR EARL BARNES, lately of Stanford University will, it is understood, on his return from Europe also accept a chair in the pedagogical department of Cornell University.

DR. NORMAN WILDE, assistant in philosophy in Columbia University, has been appointed instructor in philosophy in the University of Minnesota.

DR. GEORGE SANTAYANA, instructor in philosophy at Harvard University, has been appointed to an assistant professorship.

DR. KARL GROOS, of Giessen, has been appointed professor of philosophy at Basel.

AT the Ithaca meeting of The American Psychological Association an appropriation of $100 was made from the funds of the Association for the work of the committee on physical and mental tests. Applications for grants from this fund may be made to the chairman of the committee, Professor J. McK. Cattell, Columbia University, New York. It was suggested at the meeting that among the purposes for which this appropriation might be used would be the construction of anthropometric instruments, the printing and distribution of record blanks and the calculation and publication of data.

THE Berlin Academy of Sciences has made a grant of 700 Mk. to Professor J. Freudenthal for researches in the life of Spinoza.

THE *Revue des Revues* has recently published an illustrated account of the laboratory of physiological psychology at the Sorbonne, under the auspices of the École des Hautes-Études, directed by M. Binet. As the article states, there are, in addition to that at Paris, laboratories at Rennes, Louvain, Liège and Geneva.

THE Trustees of the Teachers College, Columbia University, announce the foundation of five fellowships of the value of $500 yearly and free tuition and ten scholarships of $150 a year. These fellowships and scholarships are open to students of psychology, who would have all the privileges of the courses and laboratories of Columbia University.

IT is expected that the Dictionary of Philosophy, edited by Professor J. Mark Baldwin, of Princeton University, and published by The Macmillan Company, will appear in 1899. The staff of the Dictionary, as now organized, is as follows—Consulting Editors: *English:* Professors H. Sidgwick, Andrew Seth and William James; *German:* Professors Windelband, Ziehen, Exner, Münsterberg; *French:* Professors Pierre Janet, L. Marillier, Th. Flournoy and Yves Delage. Writers in charge of departments: *Philosophy:* Professors Josiah Royce, Andrew Seth and John Dewey; *Logic:* Professor Adamson; *Ethics:* Professors Sorley and James Seth; *Psychology:* Mr. Stout, Professors Cattell, Titchener and Baldwin; *Philology:* Professor Wheeler; *Physical Science and Mathematics:* Professors Simon Newcomb and H. B. Fine; *Mental Pathology and Anthropology:* Professor Jastrow; *Biology:* Professors C. Lloyd Morgan and Minot; *Physiology:* Professor Hodge; *Economics:* Professor Hadley; *Political and Social Philosophy:* Professor Montague, Dr. James Bonar, Professor Giddings; *Jurisprudence and Law:* Judge S. E. Baldwin; *Philosophy of Religion:* Professors A. T. Ormond and R. M. Wenley; *Education:* President De Garmo: *Æsthetics:* Professors Tufts and James Angell; *Neurology:* President C. L. Herrick, Dr. C. J. Herrick; *Bibliography:* Dr. Benj. Rand, Professor H. C. Warren; *Biography:* Professor G. A. Tawney; *Editor's Assistants:* Professor G. A. Tawney, Dr. W. M. Urban.

THE University of London has excluded Mental and Moral Science from the list of subjects that may be offered for the University's degrees in Science. A memorial protesting against this action has been

presented, in the course of which it is said: "By its attitude in the past the University of London has not a little encouraged the more strictly scientific study of psychology, both as a science of observation and in its relation to physiology. Among students of physical science a certain number have a distinct taste for philosophical study, and it is desirable to encourage such students with a view to the development both of scientific methodology and of psychology on its experimental and physiological side. The student who approaches the mental sciences from the literary side deals with them naturally in a different spirit. For the development of the subject in its relation to the general body of science it is necessary that it should be studied by some who are familiar with the principles and methods of physical science. At the present time much scientific labor of this kind is being spent on psychological inquiry in other countries. In most of the principal universities of continental Europe and America psychological laboratories have been founded at considerable expense, and foreign journals are published for the express purpose of recording experimental work in psychology. In this country efforts are being made to develop a similar line of study. The University of Cambridge has recently appointed a lecturer in experimental psychology, and a laboratory has been opened this session at University College. To all such efforts this sudden *volte face* of your university is a serious blow. We venture, therefore, respectfully to express our hope that you will readmit mental and moral science into the schedule for the science degrees, with such modifications, should they be deemed necessary, as may serve to accentuate the scientific sense in which the subject should be treated for the purpose of a degree in science." Amongst those who have signed the memorial are the Master of Balliol, Professor Henry Sidgwick, Mr. R. B. Haldane, Q.C., M.P., Professor Burdon Sanderson, Professor William Ramsay, Professor F. Y. Edgeworth, Mr. Francis Galton, Dr. A. Robertson, principal of King's College, Professor Sully, Mrs. Sophie Bryant, D.Sc., Mr. C. Lloyd Morgan, Professor Foxwell, Mr. Bernard Bosanquet and Professor Oliver Lodge.